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DRUMMOND 3½" LATHE p 111

1500 RX p. 203

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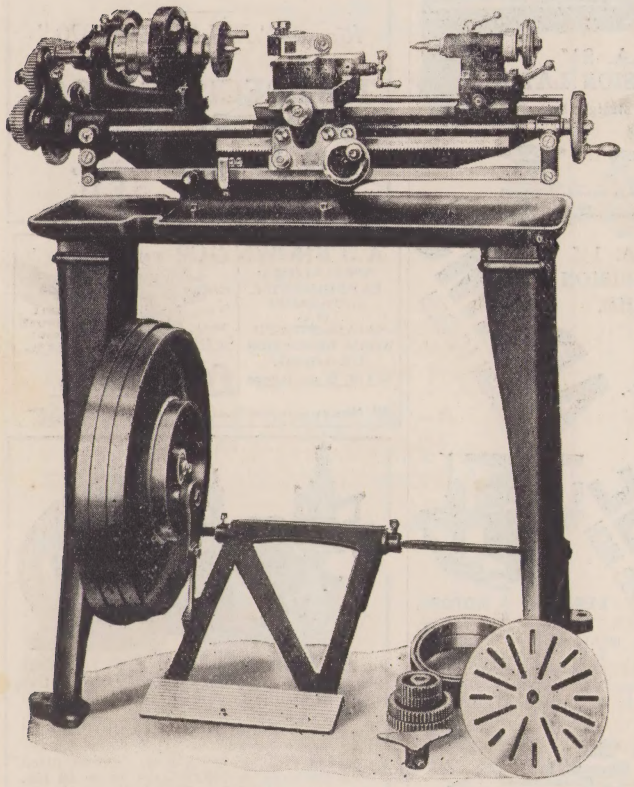

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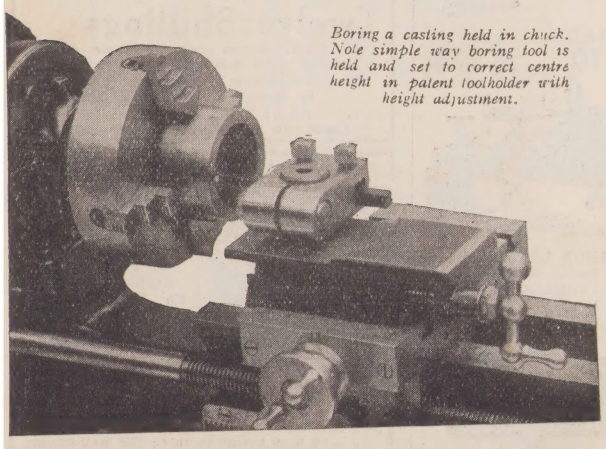
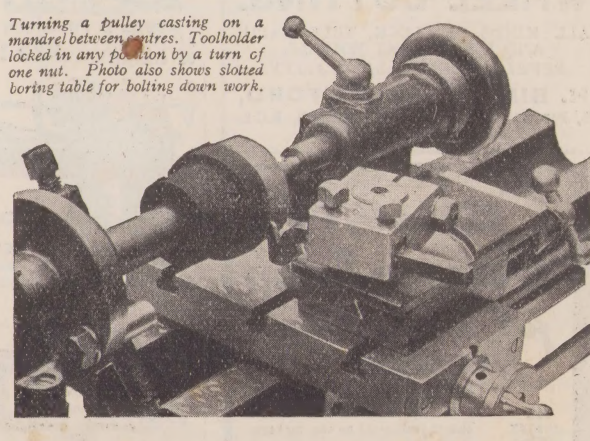


Boring a casting held in chuck. Note simple way boring tool is held and set to correct centre height in patent toolholder with height adjustment.



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SMOKE RINGS

THE next MODEL ENGINEER Exhibition will be held from September 4 to 13 next, and it will take place as previously in the Royal Horticultural Hall, Westminster. Readers will note that the period fixed is two days longer than usual. The opening day will be the Thursday, and the show will remain open till the following Saturday week. The date, place, and duration of our Exhibition are not matters entirely under our own control. The demand for the Royal Horticultural Hall for exhibition purposes, including the regular displays of the Royal Horticultural Society, is so great, that the choice of dates and the occupation of the Hall for a sufficient period is always a matter of considerable difficulty to arrange to suit all interests concerned. It must be remembered that the show takes two or three days to fit up, and at least a day to clear away, and as the Royal Horticultural Society have regular fortnightly shows of their own, it is not easy to fit in another show requiring a whole fortnight to itself. This year circumstances permit us to get possession of the Hall two days earlier than usual, and we have therefore decided to put these two extra days into the period for which our show will be open. We hope this arrangement will help to spread out the attendance and so reduce the congestion on some of the busiest days. Moreover, it will probably give some of the public an opportunity of coming who might otherwise not be able to do so. Particulars of trade stand and model competition arrangements are now in preparation, and will be issued at an early date.

* * *

OUR 1,500th number has moved Mr. Herbert Dyer, of Mousehole, Penzance, to send me a very charming souvenir of the occasion. It takes the form of a tobacco-jar, the outer case of which is repoussé worked in copper. Readers will remember that Mr. Dyer contributed to our columns last December an excellent article on making Christmas gifts for model engineering friends, and the gift he has sent me is an admirable example of skilled craftsmanship in metal-working. But it is more than this, it is an exceeding happy design, featuring a ship, a locomotive, THE MODEL ENGINEER Badge, and the number 1,500. It also bears my own initials. I have naturally written Mr. Dyer a little note of thanks, but I mention his gift here as another instance of the kindly spirit which animates our circle. He says, "I hope you will accept the jar in the same spirit as that which influences the maker—friendship. I hope its use will perpetuate 'Smoke Rings' for an indefinite time; they say copper lasts for ever."

* * *

READERS who are interested in THE MODEL ENGINEER "1,500" wireless set, and they are a good many, may like to know that sample sets will be on show during the next few days in the wireless department of Messrs. Selfridge's well-known stores in Oxford Street. All the components required for the set will be on sale, and Messrs. Selfridge's staff will be pleased to demonstrate and explain the set to all interested callers. I am quite sure that many readers will want to build this design when they have experienced the excellent and efficient reception it gives.

* * *

THE remarkable effect of automatic machine tools and mass production methods on the prices of motor-cars and other articles involving the use of machined parts is not very widely understood. People know that prices have been reduced in a very substantial degree, and have some vague idea that mass production is at the bottom of it, but the part played by the introduction of high-speed steel and the resulting improvement in machine-tool

design is not fully realised outside the industry. Sir Alfred Herbert made some interesting comments on this subject in a recent article in the *Daily Telegraph*, from which I extract the following: "A rough measure of the producing capacity of the different classes of machinery to which I have referred may be given by the following example: Let us take a piece of work, such as a gear blank, of which two can be produced in one hour by a competent turner operating an ordinary lathe; on a semi-automatic capstan lathe with properly designed multi-cutting tools, the same piece can be produced by a man or youth at the rate of ten pieces per hour; the same man working a group of four automatic turning lathes, suitably equipped, would produce forty pieces per hour. In the simple machine only one tool is in operation at once, and each dimension has to be obtained by careful measurement; on the semi-automatic capstan lathe a number of tools are cutting simultaneously, and all the dimensions are obtained from the accurate setting of the tools themselves combined with stops. The fully automatic turning machine uses tools similar to those employed in the semi-automatic machine, but the various motions are performed automatically and the machine stops itself on the completion of the job, the operator having nothing to do but to insert the rough casting, or forging, and remove the finished article. This example demonstrates the great reduction in cost which can be attained by the use of modern equipment."

* * *

A NEW technical sport is on the eve of development in this country. I refer to gliding, or flying in a motor-less airplane. This sport has aroused tremendous interest in Germany, and flights of many miles have been repeatedly achieved. In fact, one authority has expressed the opinion that as skill and knowledge of the proper utilisation of air currents increases, flights of as much as 200 miles will be possible. A British Gliding Association has been formed, and I have already been asked by a reader of THE MODEL ENGINEER for advice in starting a local gliding club. I shall publish some further information on this subject in an early issue.

Percival Marshall

Models and Engineering Progress.

A Model Astronomical Telescope.

A tentative model of the proposed 200-in. reflecting telescope for the California Institute of Technology is now on view in the National Academy of Science in Washington (D.C.). The mirror will have a focal length of 55 ft. and the telescope will have an equatorial mounting.

Amazing New American Buildings.

The last year marks the completion in New York of two of the tallest buildings in the world, the Manhattan Bank Building, the top of which is 925 ft. above the sidewalk, and the Chrysler Building, which reaches a height of 1,030 ft. (30ft. higher than the Eiffel Tower!), and contains sixty-six storeys and six pent-house floors.

In Los Angeles (Cal.) a building is being planned whose roof will accommodate an aeroplane landing field 1,200 ft. long and 200 ft. wide; while Chicago has beaten all previous records by constructing what is claimed to be the largest single building in the world.

Overhead Express Motor Roads in New York City.

New York City authorities are now building an express overhead motor road on the West side of the city, along the Hudson River front. The roadway is supported by structural steel columns, and provides for two separate roadways each 30 ft. wide.

The overhead structure will extend for four miles when completed, and the columns are being built of sufficient strength to support a second roadway above it if warranted by increase of traffic.

Plaster Model Tests for Stresses in Beams.

At the University of Illinois Experimental Station a new method of studying the stresses in curved beams has been worked out involving the use of plaster of Paris models. The method is based on the fact that the plaster is almost perfectly brittle, having a straight-line load determination up to rupture; therefore the relative values of rupture load of two plaster members will correctly represent the relative stresses in similar members of ordinary ductile materials.

Omnibus Accumulators.

In the L.G.O.C. service three types of accumulators are employed, there are: H & S with a 110 ampere-hour capacity, at 12 volts; the N-S type, of 150 ampere-hour capacity; and the L.S. type of 250 ampere-hour capacity.

The last-named is used for starting as well as lighting, the first two for lighting only. The batteries fitted in the six-wheel petrol-electric vehicles also furnish current for building-up the generator field.

New High-speed Tanks.

It is stated that an experimental tank weighing 20 tons with a speed of 20 miles an hour is now being tested for use in the Army, and that a new tank weighing 16 tons is now being manufactured.

Another experimental tank recently did the journey from Farnborough to Lulworth in faster time than an ordinary motor-car, and during the trial attained a maximum speed of 45 miles per hour.

The Restoration of No. 1, an Old 1½-in. Scale S.E.R. Model.

Some Further Notes on the Progress of Work in Rebuilding.

By Geo. Gentry.

General Note.

THIS model is the 1½-in. scale old S.E.R. single-wheeler, which is in the hands of the brothers Willoughby for rebuilding. It is now nearing competion, but some of the earlier procedures in restoring will be found described on page 30, July 12, 1928, issue, where the rather intensive work on the cylinders was described and illustrated. The article on "Painting a Loco Chassis," by N. D. Willoughby, on page 407 of the 1928 issue, has to do with the same model. Further, we have recently given a short illustrated note on "Hammering Out a Brass Coping," which is a job incidental to the rebuilding of this interesting model (see last weeks issue).

The Boiler.

Fig. 1, is a view of the right-hand side of the boiler, after the reconditioning had been completed, showing the footplate mountings, together with the original cast dome (in two pieces, below), and Fig. 2 the opposite side view, indicating the front tube plate, and the front of ashpan with damper open. It is practically all of copper, except the new dome, of gunmetal, and the sizes are 3/32nd-in. plate, 22 ins. long overall, of which the shell is 15 ins. by 5½ ins. diameter. The firebox shell, or wrapper, is 6⅛ ins. wide. There are seven 1-in. tubes. The firebox itself is 5½ ins. wide by 6 ins. back to front and 7¾ ins. deep. The shell is in one plate, with a single riveted lap joint on the underside (not seen in either photo).

As mentioned elsewhere, the boiler as it was had no lagging, and as this is being provided, the paint has been all removed from its exterior; but the most important alteration has been the provision of a new dome. The one that was on was, as seen in Fig. 1, a thick brass casting, saddled to the boiler shell over an oversize opening, and attached to the same by a matter of two dozen 3/16th-in. Whitworth countersunk head iron screws, put in at a variety of angles to tapped holes in the plate and to a 5/16th in. brass thickening ring riveted to plate on inside. These screws at first defied the ordinary persuasion, so, with that vim characteristic of these brothers, the dome head was sawn off, disclosing the right kind of swan-neck regulator, fitted with a vertical slide, operated by a connecting-rod (of sorts) from a crank on the regulator rod. This was all dismantled, and the business began of getting the screws out. How doesn't concern us a deal, except to say that nearly all were drilled out, but they came, as seen by the two parts in Fig. 1, but it was necessary to saw across the base ring to get it off. Then it was, how to make good? And the answer is seen in the two pictures. A copper replica, but flat, of the dome base was made, 3/32nd in. thick, and fitted, and in which is a somewhat smaller hole, to which the base of a new gunmetal lower flanged dome was securely riveted and thoroughly caulked by a flooding of soft solder inside and out. This joint has eight large copper rivets, and is intended to be permanent. The fitting of the copper wrapper to the existing holes in the boiler was a work both of patience and judgment. Mr. Willoughby had made for this a set of two dozen countersunk-

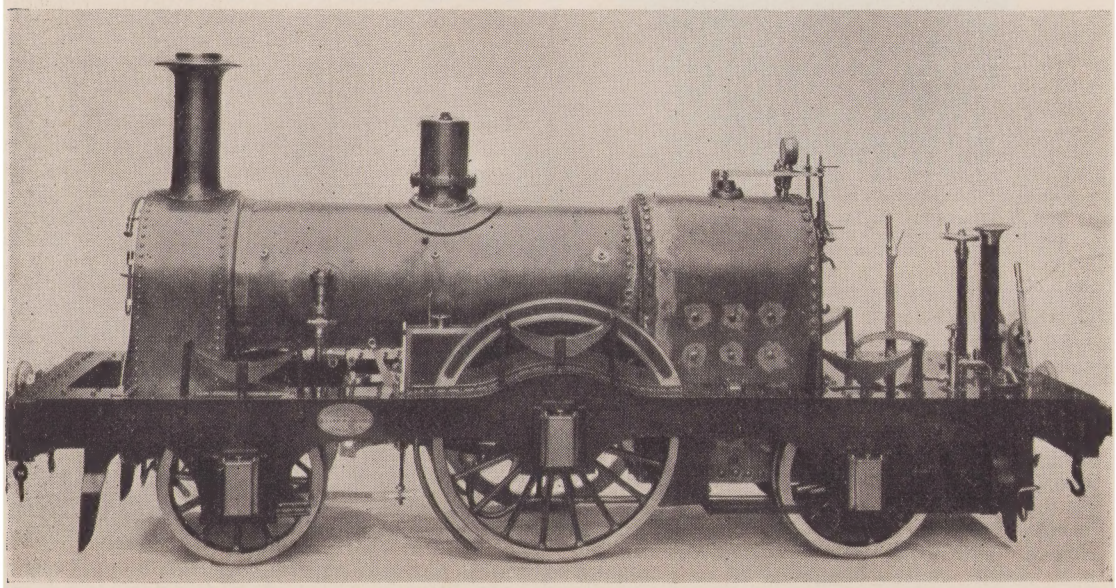


Fig. 5.—The Reconditioned Boiler, not yet Lagged, as mounted on the Chassis.

head gunmetal screws 3/16th-in. Whitworth full, which screws had extra large and deep heads slotted well above the countersink, the threads corresponding to the tapped holes but rather full. The wrapper was laid in position and marked from plugs in the holes, and thus drilled to match, and finally the screws were fitted to countersinks made to take the heads as they set into them. The screws were then driven home tightly by wrench action, and finally filed off flush. An examination of the two photos will prove that the result is quite a good job, especially considering the slipshod manner in which the original joint was made. The whole

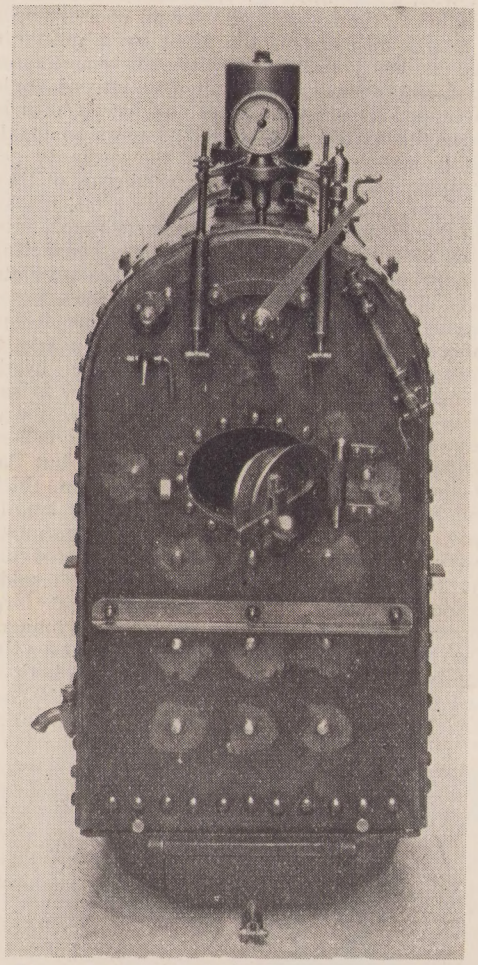


Fig. 3.—Back End of Model Loco Boiler. Since photo was taken a new steel latch has been made for the fire door.

of the dome base up to the flange can be considered as permanent jointing.

As has been mentioned before, this model exhibits all the general detail of the standard single drivers as designed and constructed by R. Stephenson & Co. in the middle of last century, and as exemplified by the famous Midland singles of 1852. It differs from the Sharp singles, for the same railway, of a year or so later, because these engines had domes hard up to the funnels, but both had plain domes. One must not confound these engines with similar chassis designs of historic interest by Stephenson and others, of a few years later, and which were built for the Lombardo Venetian Railway. They had spring lever safety valve domes over the firebox, and those for the Italian State Railways which had centrally placed domes with lock-up safety valves. All these were very similar as to design of chassis, excepting that the leading wheels were somewhat larger than the trailing. The Midland engines had same size wheels fore and aft as No. 1, and had a plain centrally placed dome, and, fortunately, we happen to have scale drawings of these very locos in THE MODEL ENGINEER library, which has helped our friends very considerably in such amendments as have been found necessary. In any case, although of S.E.R. origin, and bearing characteristics of detail design attributable to both Craven, of the Brighton, and Cudworth, of the S.E.R., there is no doubt that the fundamental origin of this model was a Stephenson single, and it is proposed, therefore, to complete the plain dome cover of brass on Stephenson lines.

One or two other practical points in fitting the dome may be of use to readers attempting a job of this calibre. The wrapper beneath the dome was first made with no opening in it, and it was in this condition when the new dome base was riveted to it. The inside of dome base was bevelled slightly, and, in this blind space, solder was run all round to fill the inside. The steam opening was then cut out. After this, the wrapper was not put on until all the work in connection with re-conditioning the regulator, steam-pipe, and the fitting of a new steam blast valve had been accomplished. When it was put on, a 1/64th-in. steam joint with gold size and red lead was put between it and the plate, and all the screws were screwed home on and into the size and red lead composition, which at first was allowed to harden. Then steam to about 5 lbs. was put in the boiler, and, while hot, and with the jointing softened thereby, all the screws were driven home, as described, and this forms the permanent joint, which has proved absolutely steamtight under all conditions of test. It will be seen that there is a screw plug fitted to the dome top, which is intended for inspection and oiling of the regulator when necessary. The dome is turned and finished inside and out, and is really an excellent job, indeed, from the writer's point of view, too good, in this respect.

The Regulator.

Fig. 3 is a back view of boiler, showing the arrangement of the fittings, which can be studied as to positions, which have not been altered. Everything seen, except the actual double safety valve, comes within the spectacle plate of the cab. The regulator, as a whole, only exists as it was in the actual handle and the hood of the valve in the dome. The handle had a 7/32nd-in. round hole in its boss, which was fitted with a taper pin. This hole was opened out to $\frac{1}{4}$ in., and plugged with steel, silver-soldered in, and this plug was re-drilled and drifted square to match the new gunmetal rod. Beyond this, the stuffing-box is all new, and also, since the photo (Fig. 3) was taken, the quadrant has been remade. That in the photo is original, and it follows the boiler curvature. A new one, since made, follows more nearly the curvature struck by the handle. At the forward end of the regulator rod is an

original bearing, attached to the thickening ring beneath the dome wrapper. This was opened out by means of a short reamer, and the rod made with a collar bearing on the back face. On the nose of the rod is put a new disc crank, which operates by means of a new gunmetal connecting-rod, the new vertical sliding valve of the regulator. Working from beyond the stand-pipe of $\frac{1}{2}$-in. copper, is a gunmetal elbow, and $\frac{1}{2}$-in. steam-pipe, all new. The front end of steam-pipe is flanged, and bears on a new face cut on inside of front tube-plate. The flange is fitted with 3 B.A. gunmetal studs which pass through the plate, and has the flanged nipple to the steam elbow nutted to it. The remainder, all new, is as seen in Fig. 2. Here the small union junction to steam-pipe, seen low down, is for the cylinder lubricator. At the flanges there are steam joints fitted on both sides of the tube-plate, and all, by test, is quite steamtight.

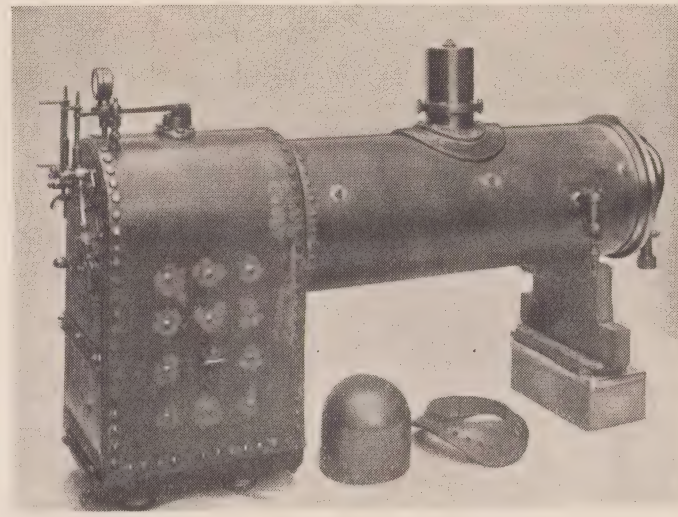


Fig. 1.—Boiler of No. 1 after Reconditioning, showing the Old Dome below.

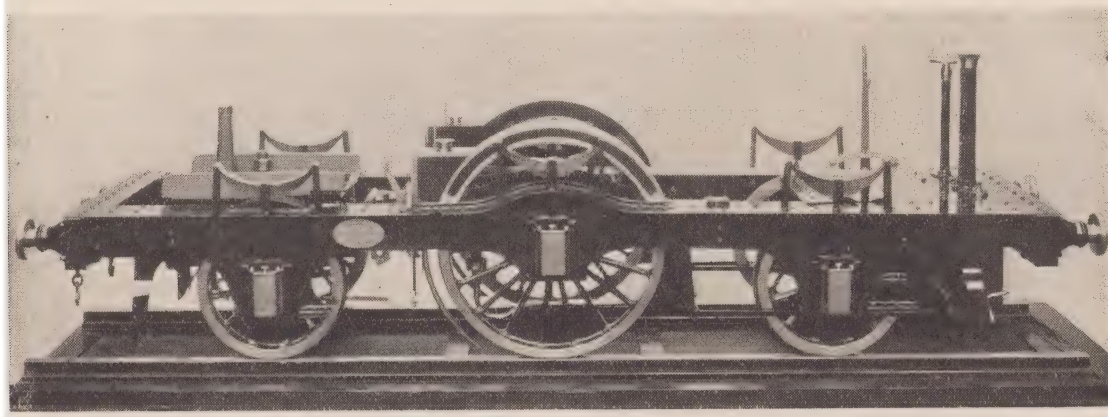


Fig. 4.—Chassis of No. 1 as rebuilt. The link motion hangers are shown temporarily supported.

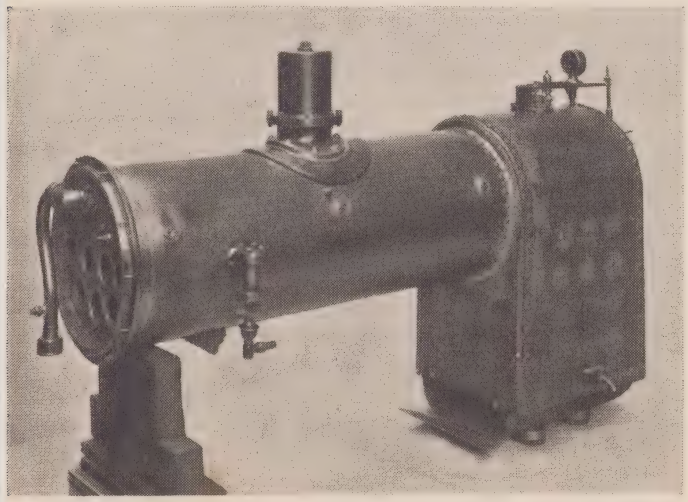


Fig. 2.—View showing Front Tube Plate and Ashpan Damper open.

The Safety Valve and Other Fittings.

The portions of the original remaining are the gunmetal seating, the valves, levers, spring plungers, and nuts, and spring casings. The fulcrum pins, valve-pin knuckles, springs, and pivot lugs at bottom, are all new; and, in addition, distance tubes have been fitted over the screws of the plungers to prevent the driver from screwing down the valves below the 45 lbs. blowing-off point, or rather to above that point of blow-off.

The whistle is the original, but has had its plug ground in. The single water gauge, to the right, is also original, but has had its steam and water ways from boiler opened out, plugs ground in, a new screw plug at the top, and the glass ejecting cock at bottom has had fitted a small union with drain pipe attached to carry drain water below footplate. The water-gauge cock, to the left, is entirely new, and the stuffing-box, spindle, and

handle of the blower above it quite new. There was, originally, a plain plug cock fitted inside the boiler, hard by the regulator, to act as a blower cock. This has been replaced with an ingeniously constructed needle valve, which is studded and nutted to the boiler shell. The screw-nut can be seen on the outside of boiler in Fig. 2. It will ultimately be hidden under the lagging cover.

Among the other fittings, the firedoor is as before, but has been drilled both inside and out with vent holes. It has new hinge pin, and the hinge fixing studs of gunmetal are new and are fitted with steel nuts. The boiler drain cock, seen both in Figs. 2 and 3, is as before, but has been fitted with a handle. Both clack boxes have new wing valves, with seatings remade and ground in. They had the large cocks on, but these have been tightened up to prevent them being operated. One clack is in connection with a crosshead feed pump, and acts with a by-pass, and the other is attached to a hand feed pump mounted on the footplate in the coal bunker. The union joints on the clack boxes have all been remade. Originally, or as taken down, the boiler was attached by the firebox shell to the frames. Now it is mounted in the proper manner, being attached to the frames by the smokebox, the firebox having only clamped cleats to the footplate, and allows thus for expansion. All these cleats and angle supports are new.

The Ashpan.

The only addition to the foundation of the firebox is that an inner square copper foundation has been fitted for the support of the grate bars which before rested on the ashpan. The latter is the original, only that all the damper gear is quite new, and new hinge pins have been fitted. This work was done entirely by Mr. N. D. Willoughby.

The Chassis.

Fig. 4 shows this as exhibited at the 1928 Model Engineer Exhibition. The wood supports for the motion hangers, or swing links, are temporary. About this more will be given later on. Fig. 5 shows the same with the boiler as reconditioned and mounted. As shown here, the biggest job to be seen is the smokebox, of copper, which is entirely new, and will be described with the funnel improvements in the next instalment relating to this model.

In this picture one can see the position of the hand feed pump, and the by-pass valve of the crosshead feed. Work carried out by Mr. G. S. Willoughby. The making of the well tank, and its standpipe is by N. D., and will need a later reference. As also the brake gear.

One ticklish job, in this setting up, was the refitting of the swing-link bracket under the boiler, which, due to bad original fitting, and that the front of boiler was set down nearly $\frac{1}{2}$ in. lower than it is now, was considerably out of line. It is due to the perseverance of G. S. that this portion is all in order, and the same rebuilder did all the work as described on the boiler, and also made the new smokebox.

As seen in Fig. 5, the loco, on several occasions, has been put under steam (gas fired), and the writer has been privileged to drive it, running on the floor-boards. Perhaps the best thing that can be said of it is that it functions under steam equally with its companion "Peter," which is in its favour, seeing that it is not nearly so well sprung as is that particular model.

The Practice and Art of Polishing by the Buff.

By C. H. Chaplin.

IN the first issue of The Model Engineer for 1930, a correspondent asked, in effect, how he could get better acquainted with a machine he had had for some time without knowing its uses! This is the primary cause of the following remarks.

Polishing in General.

The finish of an article that is intended to be admired as well as used is a matter of supreme importance. But there is *all the difference* between proper finish and an overdose of it. One instance may be given. In a recent exhibition of turnery at the Mansion House, a very well-executed piece of ivory work was disqualified *because the polishing had been overdone*! All the *sharp edges*, showing correct workmanship with keen tools, had been *rounded off* on the buff (N.B.—Careful use of buff will prevent this defect!), and away went the prize with those sharp edges. One expects to find articles made by repetition machines come off with pressed, *i.e.*, rounded edges, but good craftsmanship should not be guilty of such nasty faults. Buffing will not correct them; it may even accentuate them. For this reason skilled work will *always hold* its own! So here is our "be careful" part of this article.

The Wide Range in Polishing.

Glass, wood, metal, marble, and many widely differing materials are polished, but not all the same way! The thing to remember is that you should so work as to avoid *as far as possible* any after treatment. For instance, if you do any ornamental turnery, you will only do good work by using tools that are sharpened on the Goniostat—an instrument for holding the cutting point at any required angle with certainty. Then the work is left polished, as the edge is not only keen as a razor, but itself being polished after the sharpening, there is as much polish on the work as on the tool. Only then is a brush-up with a stiff brush necessary, and the work is done. This applies to articles in such materials as African blackwood and Ivory, and I mention it because the thing I urge is that this fine wood can with advantage be used for bases of models, and such beautiful work as is done and shown in The Model Engineer exhibitions would be

enhanced by its use. If on the plain wood beautifully turned there is added the merest touch on the buff with a suitable dressing, the result is all that can be desired. (Details anon.)

But the use of the synthetic materials is finding a place in the workshops of the model-maker for various purposes, and I therefore follow with a few remarks on the working of them.

Working of Erinoid, Lactonit, Galalith, Esbrilith (Casein).

All casein materials work well, both to turn, drill, cut, or file. They will take speed and keen tools, but the finish will be matt, and the finish required can be got either on the buff (see on) or by using either oil on a piece of rag or felt, or a touch of Tellurine powder on the rag. In interstices you can get a finish by putting oil in and brushing out with a stiff brush. Brushes, too, are made for the buffing machine and can be slightly dressed with oil. The finish is pleasing. The high gloss can only be got on the calico buff. Erinoid can be warmed in hot water—just under boiling—and pressed to shape.

Bakelite, Jewelith, etc. (Resins).

These require a slow speed in turning. They are brittle, and are best cut with a double-edged tool, as this will not be so likely to dig in or chip the work. Finish as for the previously mentioned materials will do, and the buff for high gloss. It must be remembered that all these various made-up stuffs have a skin on them, so that the best effect is got by cutting well under this skin. For this reason, too, when you order up, you should allow for the waste in removing the top scale. Every single or mixed colour can be got, and are well worth consideration.

Buffing and the Polishing Head.

If a number of circles of calico are cut and mounted on a spindle, and revolved at speed—1,500-2,000 revolutions per minute—the result will be a stiff wheel against which you can press hard. If, then, you dress this with an abrasive, you can remove the marks left by tools and get a brilliant polish. The better the work the less the finish required. For all articles to be nickel-plated, there must be a removal of every mark, as even the faintest scratch is seen through the nickel. The matt effect on nickel work is got by the sand blast. But the buff can be used to finish model work prior to a coat of either cold or hot lacquer, or the now much-used cellulose clear varnish. If you use one of those knife-cleaners on a handle, which can be bought at any shop, a very good first finish can be got prior to the buff. I note that *on gunmetal* these cleaners have a chemical effect—giving a reddish discoloration, which is effective. If graining is done quickly on the top of this, it is very pretty, and may be made permanent by a coat of lacquer.

It should be remembered that what is called the "filling" process either of wood or other material is done and cleaned off before any attempt at polishing is made. Wood fillers can be got, but the most satisfactory stuff is made from the material itself. Say you are using Macassar ebony—a very fine and pretty wood for bases—you can fill any defect therein by filing off some fine dust from the wood and mixing it with a little "Durofix," or, less good, a little glue. Harden and clean off. To get the effect of splendid finish on Macassar ebony, you can use the calico wheel on the buffing machine, having what is called the "G" buff, by Cannings, of Birmingham. Hutchinson, of Clerkenwell, will also supply all materials. The dressing on a "G" buff can be Canning's "Lustre" and—preferably on another buff—followed by "White Gloss." This is fine for ivory, too. Hutchinson's "Porthos Compo" is a very fine abrasive. These firms supply for all kinds of requirements, and specify what is best for the job, or will advise. Be careful in buffing never to hold the work too long in one place. The work gets *burned*, especially at the edges, when too much heat is generated. Also keep your fingers clear! To burnish your nails try the buff. You won't hold *them* there too long!

It may here be well noted that in the case of any of the made-up materials, as Erinoid, you can produce a curve on the work while buffing, and to retain it keep it so till the generated heat has escaped. This is handy at times.

One can make up other useful things to operate on the polishing head. For instance, if you turn up a boxwood disc $\frac{3}{4}$ in. or 1 in. wide with a small $\frac{3}{8}$-in. centre hole and cut a slot $\frac{1}{8}$ in. by $\frac{1}{4}$ in. deep, next giving it a wider top with a fish-back file, you can fix around the periphery a piece of emery tape and tuck the ends in this gap, glueing it on and securing the ends with a wedge, the latter cut off flush. This is a very useful gadget. If, instead, in the centre of such a wheel you bore a decent hole, you can use this by fixing it on the three-jaw chuck. If, then, you wish to produce a curve in your work, you can cut the wheel to such a diameter as will give the exact curve you want and all *filing* is eliminated. You can also face the front with sheet emery for use in trueing up end pieces. I use many of these, and can testify to their general utility.

In conclusion. For use on polishing heads, you can get all buffs from soft swansdown to hard calico; also, wire scratch brushes. There are also stiff brushes of bristles, and those of soft hair. Leather buffs can be got, and wooden ones, and felt. All these require dressing, and the dressings are in great variety, but those I mention above are the more generally useful. Speed is essential. The higher the speed the quicker the cutting. Do not polish metal and Erinoid or wood on the same buff. Buffs are cheap, so have plenty.

Clean off all work with a soft cloth after buffing, and wrap in tissue paper till required.

In fitting up a buffing wheel, always fit a cover over that part of the wheel from you to prevent the flying abrasive from distributing itself all over the workshop; and keep bearings well oiled.

In view of the chief interest attaching to the finishing of wood, I would add that a very fine finish can be got with a mixture of "Tellurine powder" mixed with the ordinary oil used on machinery, the same applied to the mop, the latter being swansdown. Then lightly finish with "White Gloss" on another buff. Avoid sandpaper if you can as scratches are hard to get out. If you use it, select already worn stuff softened with oil.

Give all work a final rub over with a very soft cloth such as "Selvyt."

Draw-in Split Chucks *versus* "Push-in."

The only advantage a push-in type of split chuck has over the other type is that the total bore of mandrel is available to use with it. A doubtful advantage because the bore of the chuck itself limits the through way. On all other counts, the draw-in chuck has the advantage when used with a hollow draw-spindle. The master advantage of the split chuck idea is that the operator does not have to rely upon the accuracy of an internal thread fitting to an external thread as is the case of all screw-on chucks. A little wear, a few grains of cuttings embedded in the threads, and the chuck is out. Similarly, the push-in split chuck has to rely partly upon the screw idea when it is pushed in by a nut. If it is pushed in by a complication of parallel running glands or washers in which the ultimate nut truth does not come in, it is a considerably more complicated and expensive arrangement than the use of a draw-spindle. For absolute truth of grip there is nothing to compare with a drawn-in split chuck when its cone head is drawn to a female cone turned in the solid mandrel nose. Nothing comes in the way of operation dead up to the jaws, and so long as the tail end of the draw-spindle fits the true bore of mandrel, the chuck body fits the same, and work gripped is not more than a very narrow limit of undersize, there is nothing to put the chuck out. It goes true even if the chuck prongs are sprung a little out.

As a general thing split chucks should be keyed, but the main reason for keying, as is done on small horological lathes, is that the drive is positive, turning with the lathe running either way. Apart from this, it prevents the chuck from self-tightening, when running normally, but in practice, unless great stress (due to poor tools or over stress turning by deep cuts) is applied to the turned work the likelihood of self-tightening is not a great consideration. If hollow work be gripped, split chucks should certainly be keyed.

Mounting a Lathe Flywheel to Make a Foot Motor.

It is required to mount a 56-lb. treadle wheel bored with a 11/16th-in. hole, to use as a foot-motor, and it is desired to know whether ordinary or ball bearings should be fitted, and whether cast steel is suitable for any kind of shaft. To begin with, we may say ball bearings are not necessary.

The simplest method of doing such a job as this is as described and illustrated in our book "Building a Lathe," by Burford, price 10½d., post free. The process is, briefly, to build a bracket with adjusting slot, and, although the wheel is bored all too small, fit it, in the first place, running on a 11/16th-in. stud. Friction will be at the minimum, and if the stud is of cast steel, annealed, it will never break.

Nothing is mentioned in the particular case we have in mind about the crank, or whether there is a crank-pin on the wheel. Assuming there is, make a stud up out of a piece of 11/16th-in. cast steel in this manner: Slip the piece of cast steel through the bore of wheel leaving about ⅜ in. of the steel projecting. Through this put a split-pin outside a washer. At the other side of wheel mount a collar (set-screwed on tightly will do) about 1 in. wide and 1½ ins. diameter. Behind this again put the steel through a slot in the standard or bracket, which may be about 1½ ins. thick, and fit it behind the slot with a washer and a ⅝-in. nut on the steel, the latter being, of course, turned down and threaded. The threaded steel stud will now be held rigid in the bracket and the wheel will run freely on the stud.

If it is proposed to use a separate crank, key the wheel and crank respectively on to each end of the 11/16th-in. shaft and run the intermediate bit of shaft in a long bearing. The latter may either be formed in the bracket itself or a good gunmetal lined plummer block can be mounted on the bracket.

The bracket must be of cast iron unless a separate bearing be used; in which case it may be of hard wood.

The stud and crank-pin should not be hardened. A study of the book just mentioned will make clear many other details in such a job as this.

The Victoria Model Steamboat Club.

Club Events for 1930.

Opening of season regatta.—April 20, Easter Sunday, at 12 o'clock sharp. Open to all power boats, clubmen or unattached.

May 18.—"Instone" Cup Steering Competition.

June 8.—"Biggs" Cup, nomination event, The Model Engineer Cup, steering.

July 6.—"Curtis" Cup, speed, circular course. "Wembley" Cup, steering.

The Salter Prize of £4 cash for three bulls-eyes is still open for competition.

October 5.—Last regatta of the Season.

Hon. Secretary, W. Poole, 396, Old Ford Road, Bow, E.3.

Safety First in Speed Boat Running.

We hear that the Victoria Model Steamboat Club have adopted a "safety first" policy in connection with high-speed running on the circular course. They are now using two lines to connect a boat to the central pole. One line is from one to two inches longer than the other, so as to give the boat a second chance if the running line gives out. The lines are attached to the boat by two separate fittings. Members of other clubs intending to compete in Victoria Park events should have their boats prepared accordingly.

The PRACTICAL ELECTRICIAN
LIGHTING·POWER·MAINTENANCE·REPAIRS

Modern Electrical Installation Work.

By Frederic H. Taylor,
A.M.Inst.E.E., A.M.Inst.M.E.

Lifting Floor-boards.

ORDINARY wood flooring may consist of either plain boards or boards which are grooved and tongued. Naturally, the lifting of plain board flooring is the simpler job of the two. Having selected the board you wish to lift, look for its two ends. If you can see and also get at each of them your task is very much simplified, but if not it will then be necessary to cut the board. This operation should be done at a joist The best way to proceed is to drill a hole with brace and bit near to the joist, then in this hole insert a "key-hole" saw, sometimes called a "pad-saw," with this cutting the board right across. With a chisel and a hammer it will then be an easy matter to lift the board. Should the boards be grooved and tongued, it will be best to cut through the wooden tongue with a fine tenon-saw, and, this done, to proceed to lift the boards in the usual way.

Cutting Joists.

When it becomes necessary to take a run of conduit (or lead-covered cable) across the joists, obviously a slot has to be cut in each one so crossed over. Two points should always be observed: (1) So arrange your runs that you cross the joists as near to the wall as possible; and (2) *only* cut a notch in the joist sufficiently deep and sufficiently wide to receive the conduit or cable, the object of this precaution being to preserve the strength of the joist as much as possible. Disregard of these points is what so many architects and engineers object to. One has even seen holes drilled through the centre of a joist, which, of course, should never be done.

Wood Block or Parquet Flooring.

It is sometimes possible to get through this by drilling a hole of the required size with an ordinary ratchet brace. Failing this, a block will have to be cut out with a chisel, the one thus spoilt being afterwards replaced by a new one.

Getting Through from Floor to Floor.

This is usually a fairly simple matter in the case of a factory or warehouse building where no cornices exist, or equally so in a carcase building where runs may be got through as soon as the floor joists are in position. If, however, you have to cut through a plaster cornice, let the cut be made with a fine tenon-saw, making the cut no wider than is absolutely necessary. This method is better than a hammer and chisel one. It is sometimes well to put a small hole through first with a bell gimlet so as to verify your position for getting through before attempting to cut away a large hole.

Cutting Through Glazed Bricks or Tiles.

To cut through such materials as glazed bricks or tiles without a fair risk of spoiling the whole surface, or nearly so, is an operation which few can do in the old-fashioned way with a hammer and chisel. A percussion drill of the Rawlplug type will, however, be of great assistance in such a case.

Fixing to Surfaces—Wood.

To fix conduit or other material on to wood joists or matchboarding needs no comment.

Brickwork.

A wall of 9-in. brickwork presents no difficulty. For conduit pipe-hooks will be used, or, if saddles are required, it will be necessary to drill and plug the two holes for each. In the event of the wall being only a 4½-in. brickwork partition, special care must be exercised, as otherwise in punching holes for plugging much damage can easily be done. In this case and in the case of "breeze block" partitions or tiled surfaces a Rawlplug drill or jumper in place of the ordinary plugging chisel should be used, and the proper-sized Rawlplug inserted. The Rawlplug system is, of course, equally suitable on other surfaces such as brickwork or concrete.

Lath and Plaster Ceilings or Partitions.

Provided that the laths are sound a thoroughly firm fixing can be made to the *laths themselves* if necessary. It is first necessary to find the positions of the laths by drilling a trial hole through the plaster with a very fine bradawl, when its position can be readily "felt." This done, ordinary wood screws may be used for fixing, although "lath screws" are better as being less liable to split the laths.

Tools and Their Use.

If good work is to be done, the installation man must see to it that he is provided with a

sufficient and *efficient* set of tools. His kit should in any case include:—

Three screw-drivers (assorted sizes).
Two hammers (one large and one small).
Two pairs of wiremen's cutting pliers.
One pair of two-hole gas pliers.
One pair of foot-prints.
Three bradawls (assorted sizes).
Two gimlets.
Two wood chisels.
One bell-gimlet (not less than 24 ins.).
One $\frac{5}{8}$-in. augur and handle.
One ratchet brace with sets of bits.
One adjustable hacksaw frame up to 10 ins.
One pad-saw and set of blades.
One 24-in. hand-saw.
One 12-in. tenon-saw.
Two soldering-irons.
One 2-ft. boxwood rule (four-fold).
One plumb-bob and line.
One oilstone (mounted).
One oil can.
One carpenter's square.
One spirit level.
One 10-in. flat file (bastard) and handle.
One $\frac{1}{2}$-pint Swedish blowlamp.
One nail punch.
One pocket knife.

And, in addition to the foregoing, no self-respecting installation man will ever be without a decent-sized note book and a pencil.

The larger pair of cutting pliers should be 8 ins. and with square jaws and hollow back.

Two-hole gas pliers.—These are useful for holding cable sockets when they are being filled with solder, as well as for conduit work. (Pipe tongs for large conduit are provided from stores.)

Ratchet brace and bits.—A ratchet brace is always more useful than a plain brace. The bits should include twist, spoon, rose, and a screw-driver bit.

The installation man should see that all his tools are properly cared for. For instance, mates should not be allowed to open packing-cases with wood chisels nor to use cutting pliers on iron wire, or for holding cable sockets in a lamp flame.

(*To be continued.*)

Electrical Questions and Answers.

(Mainly Selected from Recent City and Guilds Examination Papers.)

31. Q.—You are asked to provide an electric bell installation in a house requiring twenty push points with the usual mechanical replacement indicators and two bells, being one for the front door and one for the house. You have the option of using a Léclanché cell battery, or of taking current from the town lighting supply, which is already laid on in the house, this latter being 230 volts A.C. 50 periods. Discuss briefly the advantages of the two systems, stating the precautions necessary to adopt to ensure both efficiency and safety.

A.—**Léclanché Battery System.**—The advantage of this system is that it is absolutely independant of the public lighting service. It is cheap to instal, and if well put in is reliable. Its disadvantage lies in the fact that the battery will from time to time require renewing. If maximum efficiency is to be obtained, the following points must receive attention:—

(1) There should preferably be two separate batteries, being one for the house and one for the front door, each being contained in a strong painted box of $\frac{3}{4}$-in. wood and fitted with a lid.

(2) There should be no looping of the push wires, that is to say, there should be a separate wire run from each push to the battery.

(3) The conductors should be of size not less than 1/.036 in., and where within doors in dry positions be insulated with at least one layer of pure rubber, served with two layers of cotton, waxed overall.

A.C. Supply from Town Mains.—The advantage of this system is that there is no battery to provide and therefore none to maintain. The installation will, however, be of greater first cost than in the previous case as it will be necessary to provide the bell transformer, which must be protected by two S.P. fuses and one D.P. switch, all of which should preferably be of the iron-clad pattern. These accessories and also the wiring from the supply point to the primary side of the transformer must be of the same quality and pattern as would be provided for electric lighting purposes, being used at the same voltage. The transformer must be of good insulation and able to withstand short-circuiting of the secondary winding should the bell jam. The resistance of the secondary must be suited to the circuit, *i.e.*, the total resistance of the bell, indicator and line must be considered. The "no-load" loss of the transformer should be as low as possible, as this loss is going on always.

32. Q.—State briefly under what conditions earthing is necessary and also what are the principal points to observe where earthing is to be carried out.

A.—Earthing of exposed metal work is necessary where the pressure exceeds 30 volts if A.C. or 100 volts D.C. Earthing is also necessary for *all* pressures of supply "in bathrooms, lift shafts, the immediate neighbourhood of running machinery, and all places where even a slight shock might lead to serious accident" (I.E.E. Regulation No. 96, page 67).

Where earthing is carried out the principal points to observe are: (1) The maximum resistance of the conduit or the metal sheathing of the wiring system as measured between a point near the main switch and any other point in the system must not be greater than two ohms. (2) The earthing conductor must be of a section not less than that of 7/.029 in. (.0045), and made of copper, and in any case it must be equal to at least half the section of the largest conductor to be protected, with a maximum of .1 sq. in. (3) Earthing conductors of size 7/.036 in. or larger must have a sweating socket for their connection. (4) All earthing conductors must be protected from any possible mechanical injury.

The "Model Engineer" "1500" Three-Valve Receiving Set.

By H. J. Barton Chapple,
Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

(*Concluded from page* 184.)

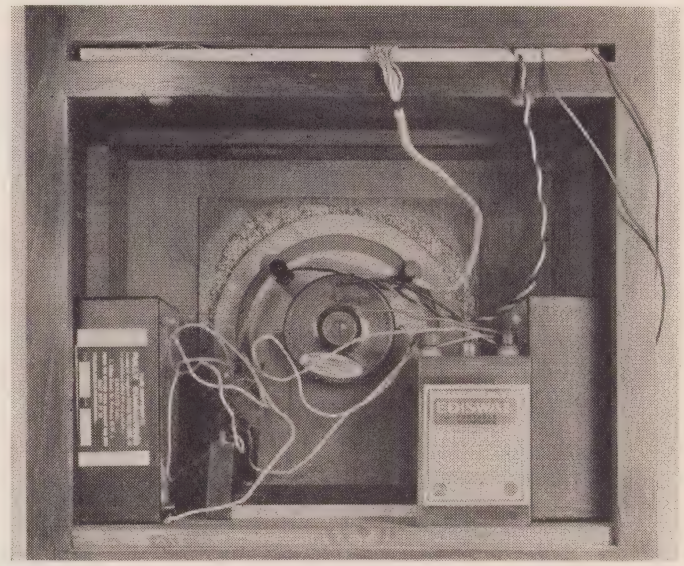
I HOPE you have all been successful in carrying out your wiring of this receiver, the full details of which were given in last week's issue. There is one item on which a slight misunderstanding might arise and that is the absence of the two terminals marked H.T.– and G.B.+. Since, as will be seen from the theoretical diagram, these two points are actually common with L.T.–, it was deemed unnecessary to include them. The one L.T.– terminal will suffice for the three connections.

When the wiring is all completed and has been checked over very carefully to make doubly sure that any of the wires have not gone astray or been omitted, the extension handles can be fitted.

Fitting the Extension Handles.

Slip the screwed end of the panel bush over each handle and pass through the holes provided in the panel. The two front nuts can then be screwed home and by means of grub screws provided at the back of the rod grip the respective shafts of the rheostat and reaction condenser. Since two knobs of different design would appear on the panel for controlling these components, I have replaced them with two arrow knobs. This gives a somewhat better panel appearance and retains complete balance and symmetry.

We are now in a position to try out under test conditions the results of our handiwork. You will notice in one of the accompanying illustrations that in giving the set a "bench test"



Showing how Provision is made for conveniently accommodating Loud Speaker Batteries and Accumulators in the Back of the Cabinet.

head-'phones have been employed. Do not imagine for one moment that the set is designed for telephone strength. This was merely for a preliminary run, the low-frequency stage being cut out temporarily and the head-'phones plugged into the detector valve circuit. You will not need to do this although some may prefer to assure themselves that all is quite satisfactory before the set is rigged in the cabinet.

An Assistant making a Preliminary Test with the L.F. Stage cut out of Circuit.

A Battery Cord.

I have suggested the use of multiple battery cord as this prevents untidy leads and is a refinement which for neatness and convenience's sake is well worth while. You can either obtain the seven-way cord and put on your own wander-plugs and spade connectors as specified, or, alternatively, Messrs. Belling & Lee, Ltd., will supply a cord of their own ready assembled. In the case of this firm the cord is actually a five-way one with the G.B.+, H.T.– and

L.T.– plugs and connectors spaced along one cord, and is very convenient. The "free" ends of the cord must be connected to the appropriate five terminals on the set, bearing in mind that L.T.– is the common point for the three connections we have just mentioned. Before joining up to the battery supply, the valves should be inserted in their holders.

The Valves to Use.

I have used two-volt valves throughout, and as a result of my own tests can make the following recommendations:—

Mullard—1st stage PM12.
2nd stage PM1LF.
3rd stage PM22.

Cossor—1st stage SG220.
2nd stage 210LF.
3rd stage PT230.

G.E.C.—1st stage S215.
2nd stage L210.
3rd stage PT240.

If under certain circumstances the volume from the set is not quite all one would desire, an H.F. valve such as the PM1HF, 210HF, or HL210 can be used in the second stage, that is, the detector position. Though the impedance of the H.F. valves is slightly greater than that recommended by the L.F. transformer makers, who state use valves with an impedance between 10,000 and 20,000 ohms, the reproduction is hardly affected although the reaction may not be quite so smooth. Take the terminal cap off the screened-grid valve, and insert the valve in its holder so that it is held horizontally. The hole in the cross screen is sufficiently large to house any of the valves mentioned. Now place the safety connector cap over the threaded stem. Insert the detector valve in the appropriate sockets, that is, the one near the reaction condenser, and, as in the case of the first valve, remove the terminal head on the moulded cap of the pentode valve, place valve in holder and clip the safety connector over the threaded stem.

The advantage of using these connectors should be immediately apparent, for if this connection was made with bare wire or a spade terminal it is liable to touch another live part of the set when changing the valves. This is not only likely to short the H.T. supply but may burn out all the valves!

The Loud-speaker.

Connect the two L.T. spade terminals to the two-volt accumulator *first*, then insert the H.T. plugs in the battery sockets. The two 60-volt batteries should, of course, be joined in series, and I suggest about 60 to 80 volts for H.T.+1, and 120 volts for H.T.+2. It is advisable to employ high capacity batteries, the total milliampere consumption being in the neighbourhood of 15 milliamperes. Alternatively, an H.T. eliminator can be used. For grid-bias, arrange the plugs so that there is about $7\frac{1}{2}$ volts negative bias on the pentode valve. It is assumed that the grid leaks, low-consumption fuse lamps and 20,000-ohm resistance have been placed in their respective holders, and if so, connect the loud-speaker across the appropriate terminals. I am using a Whiteley Boneham moving-coil loud-speaker with a 6-volt field, and can thoroughly recommend it. If you pursue the same policy, it is necessary to secure two more accumulators such as the Ediswan BW6 type used for the filaments. Join these in series with the existing accumulator and connect the field leads across the full six volts.

You will notice that the Pentamu output transformer is provided with four secondary terminals, and this enables you to choose the step-down ratio best suited to the loud-speaker in use. Full instructions are furnished with transformer itself, but if you use the moving-coil loud-speaker just mentioned, the leads (which we have on purpose made in flex from the set terminals) should be joined to S_2 and S_3 terminals. This will no doubt furnish you with the best ratio. If a cone loud-speaker is preferred, then I have had excellent results with the Whiteley Boneham cabinet patent cone type, but the constructor can ascertain on test the best ratio to suit his own requirements in this direction.

The First Test.

Now join up the aerial and earth leads to the terminals so marked, set the reaction condenser at zero, pull out both range-change switches so that the short wave windings only are in circuit and switch on the set through the medium of the centre filament switch. Assuming that the volume control, that is, the filament rheostat of the H.F. valve is set at its maximum, the baseboard push-pull switch knob pulled up to short the series aerial condenser, and the crocodile clip joined to terminal X of the A multi-coil, proceed to tune in your local station by allowing the thumbs (or one thumb if preferred), to move round the drum drives of the variable condensers.

The baseboard series aerial condenser was included to make the selectivity of this set sufficiently elastic to meet your own conditions of environment and size of aerial, and you must naturally find out on site the setting best suited to your own needs. To bring this condenser into circuit, push down the knob of the baseboard switch and adjust the condenser setting as desired. Always endeavour to make the capacity value as high as possible consistent with adequate selectivity, and if problems of selectivity do not arise in your own particular case, the condenser can be left permanently shorted.

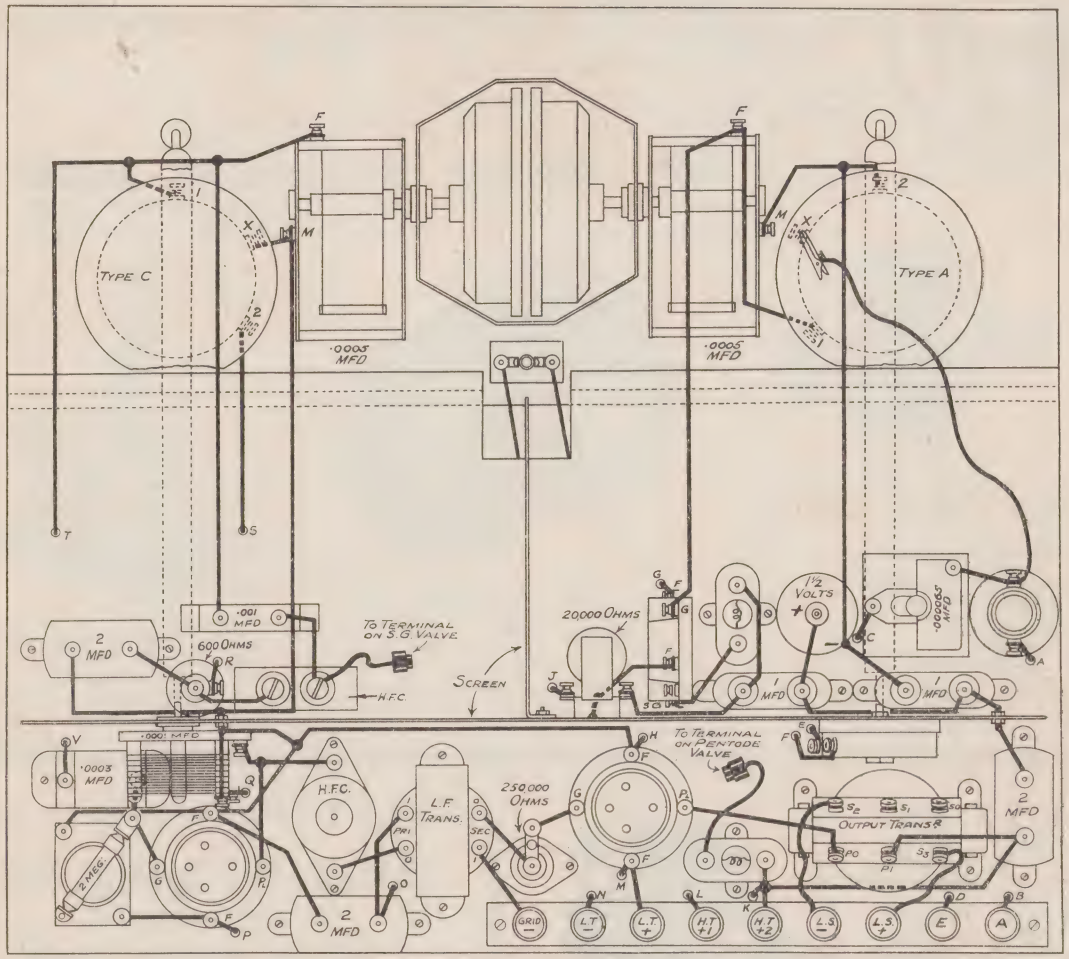
Inspiring Confidence.

Another point to note is that the set is more selective when the crocodile clip is joined to X on the multi-coil. The effect of joining this clip to the terminal marked I should also be tried, however, as volume is then greater for a given seting of the other controls. Every time you make an adjustment for reasons of selectivity in the course of your tests, it is necessary to retune slightly on the aerial condenser, that is, the left-hand milled drive.

Under average conditions, once the best selectivity arrangements have been found for reducing the pick-up from the local station to the smallest breadth of the whole tuning range, it can be left like this for both long and short waves. It is a big advantage to be able to carry out a few experiments on this aerial tuning for yourself, as it will inspire confidence in handling the set and make you more appreciative of its flexible nature.

Searching for Stations.

Since this receiver can be oscillated without causing outside interference, the tuning for



"The 'Model Engineer' 1500" 3-Valve Receiving Set.

(Specially designed by Mr. H. J. Barton Chapple, Wh.Sc., B.Sc., to commemorate the **1,500th** *issue of "THE MODEL ENGINEER").*

FULL SIZE BLUE PRINTS of the Assembly Diagram shown above, and the Base Board lay-out shown on page 183 of last week's issue may be obtained from our Publishing Department, 66 Farringdon Street, London, E.C.4, Price 1*s.* 6*d.*, or post free 1*s.* 7*d.*

EVERY READER SHOULD MAKE THIS SET.

stations other than the local is very simple. With the range-change switches either pulled out for short waves, or pushed in for the long waves, and the volume-control rheostat fully on, rotate the reaction knob until the set oscillates. With both condenser settings approximately equal, rotate the two drives together with one thumb until a carrier wave is heard. Then readjust slightly the aerial condenser drum drive until a coincident tune point is found. Now reduce the reaction until the set goes out of oscillation, readjust the H.F. tuning condenser very slightly and the station will be heard clearly.

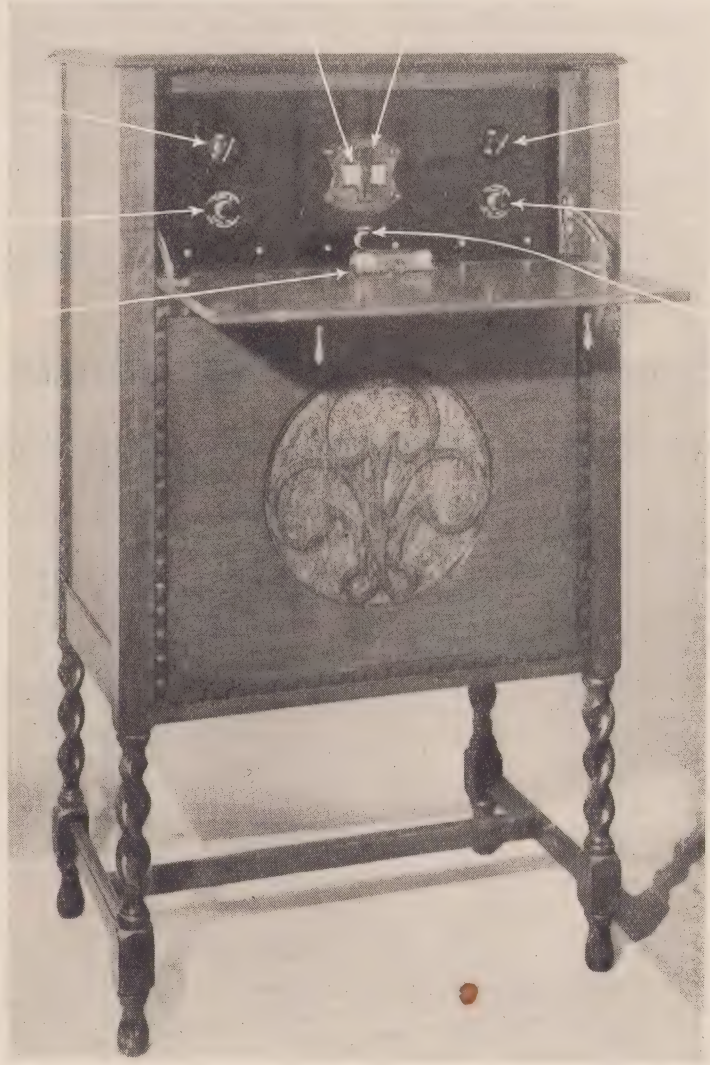
Remember that volume can be controlled either by reducing the reaction together with the consequent slight tuning readjustment, or by inserting resistance in the filament circuit of the H.F. valve by turning the filament rheostat knob. It is generally the best policy to listen to a station's transmission with the minimum of reaction conveniently possible. A careful balance between these two controls gives you a further measure of selectivity, however, and this is effected quite simply.

At Home With the Set.

Tune in the desired station at full volume, reduce the signals on the volume control and increase reaction. This will restore the volume to its previous magnitude after a very slight readjustment of the H.F. tuning drive, but any objectional background due to nearby transmissions will vanish. I think it is a good policy to spend a few evenings becoming familiar with all the controls and refinements included in this set, for it is only in this way that the fullest advantage can be gained from the receiver. Once at home with the set, however, you will find that all the claims originally made for it have been fulfilled.

Do not forget that the voltage values suggested for H.T. and G.B. are not rigid, and it is advisable to test out on actual reception to ascertain those best suited to your own circumstances. The G.B. voltages should be kept as high as possible consistent with efficient signal reproduction judged from the dual standpoint of quality and quantity, particularly the former. If desired, a super power valve such as the PM252 or DEP240 may be used in lieu of the pentode valve, although the magnitude of the amplification on the low-frequency side will be reduced if this is done.

I do not believe in the policy of giving a list of the stations received with any set, as everything depends so much on the skill of the operator, the type of aerial and earth, the efficiency of the aerial system as a whole, situation, etc. I have tried the set out on five different types of aerial, however, and its performance has been excellent in every case. I do not advise a very large outdoor aerial. A fairly short one will do admirably provided it is



The Set Complete with all the Controls conveniently labelled.

high. In addition, at least a dozen stations will be received on an indoor aerial such as a length of insulated wire run round the room behind the picture rail, but be sure and see you have an efficient earth with a short and *insulated* earth lead.

Installation.

When considering the question of installing the set in a cabinet for home use, it is appreciated that cost has to be borne in mind. If possible, however, may I suggest that the Kabilok cabinet type R/S1 shown in the photograph is admirably adapted for the purpose. The lower portion has a removable back panel giving ample room for H.T. and L.T. supply and loud-speaker. This is proved quite clearly in an accompanying illustration. The loud-speaker should be fixed on a stand (a wooden one with an aluminium strap has been used for the Whiteley Boneham one shown) and the front of the cabinet turned into a baffleboard. The whole arrangement then becomes a real piece of furniture of utilitarian value and is an addition to the home that any constructor could be proud of. In addition to the moving-coil speaker, a cone loud-speaker can also be mounted behind the grille. Alternatively, there is a table model cabinet specified by the same makers and the batteries, etc., can then be tucked away on the floor or on a small table shelf, and the loud-speaker positioned at the most convenient part of the room.

In passing, I advise you to arrange the connection to the negative side of your moving-coil loud-speaker field on the "dead" side of the filament switch, which is itself in the negative feed to the accumulator. In this way you will be sure that the speaker field is switched off when the set is rendered inoperative. If this is not done, you are liable to leave the loud-speaker in circuit and run down your batteries. Notice also in one of the illustrations that the automatic station log is conveniently mounted on the drop front of the cabinet.

I think I have now covered all the main points dealing with this receiver, and may I hope that potential constructors will not only derive considerable pleasure in making it up, but a more lasting enjoyment in its everyday use.

Everyday Wireless Hints.

Converting a Set to All-mains Operation.

By "Radiophile."

The receiver, the conversion of which from ordinary battery-heated valves to A.C. mains valves I recently undertook, was a conventional three-valver of the detector and two low-frequency stage type, coupling between the stages being by means of transformers. Although the circuit was quite a standard one, and presented no unusual features, I reproduce it in Fig. 1 so that it may be compared with the final converted circuit.

For the detector, V1, and the first low-frequency stage, V2, I decided to use indirectly heated A.C. valves, Mullard type, 164V being recommended. In the last or power stage I intended to retain the existing directly heated super-power valve, which was already of the 4-volt type, such valves functioning quite satisfactorily when their filaments are supplied with raw alternating current. The only apparatus I had to purchase, therefore, in addition to the two new valves, was two five-pin valve holders to accommodate them and a filament transformer having the primary wound to suit the local 220-volt 50-cycle A.C. mains, and the secondary giving a supply at 4 volts.

In this connection it is important to ascertain that the transformer will give an adequate low-tension output. In this instance, the transformer was rated to deliver up to 5 amperes at 4 volts, and as the two mains valves took only

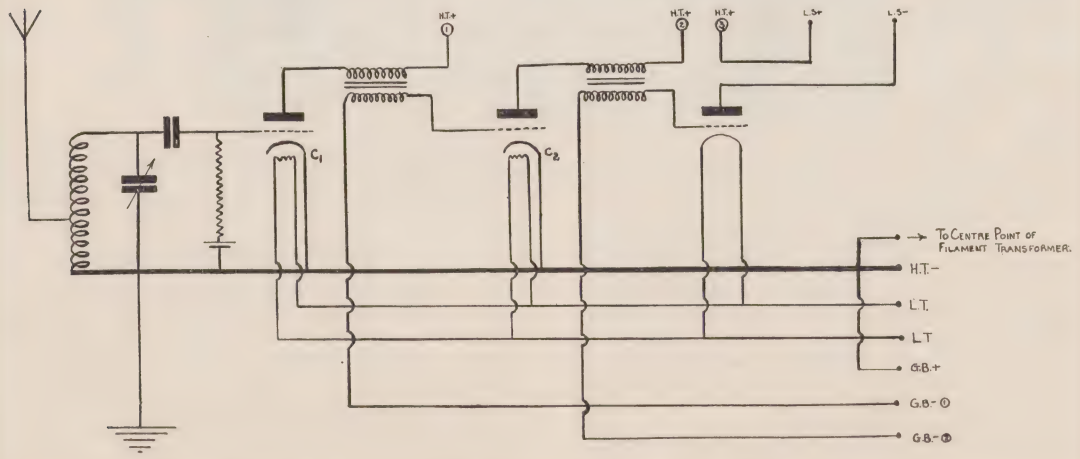


Fig. 1.—Diagram of Receiving Set to be converted to run from A.C. Mains Supply.

1 ampere each and the super-power valve only 0.25 ampere, that is to say, only 2.25 amperes in all, there was plenty in hand.

The next stage was to remove the whole of the existing low-tension wiring and to replace the first two four-pin holders by the new five-pin holders. Fig. 2 shows the theoretical diagram of the receiver when this had been done, the points C1 and C2 representing the cathode connections of the two indirectly heated valves, that is to say, the centre pins of the five-pin holders.

Remembering that the heating circuit supplying the filaments of the valves is to be an alternating current circuit and entirely isolated from the remainder of the wiring, the next step is to wire to the filament terminals of the valve

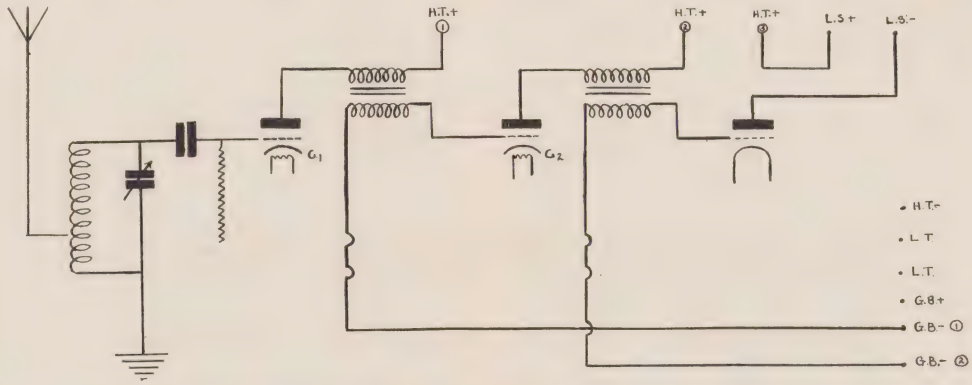


Fig. 2.—Showing Theoretical Diagram after Removal of Existing Low-tension Wiring

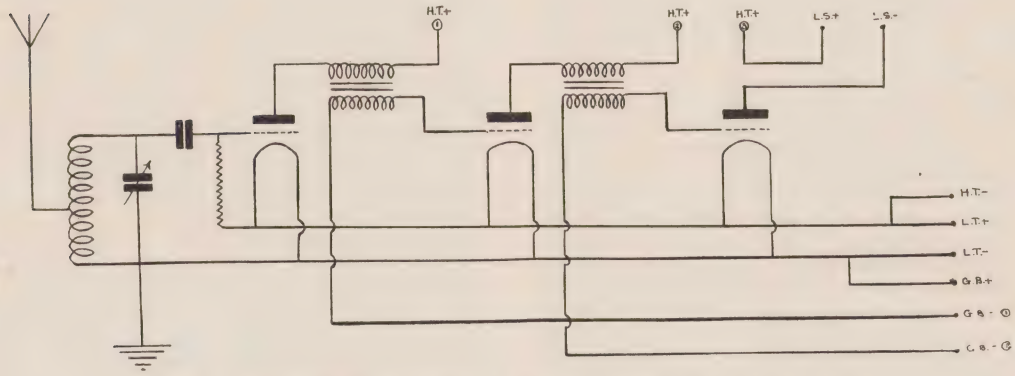


Fig. 3.—The Filament Terminals of the Holders wired with Twisted Flex.

holders, using twin twisted flex in order to minimise the risk of introducing hum due to magnetic inductance. For simplicity's sake, this part of the wiring is shown with ordinary straight conductors in the diagram (Fig. 3).

Now comes the point where it is easiest to make a mistake, although in reality it is perfectly simple and straightforward. A common return or cathode bus-wire has to be run, and to this common conductor the independent cathodes of the indirectly heated valves, the H.T. negative connection, the grid return leads, *i.e.*, grid bias positive connection, the bottom ends of tuned circuits, and the centre point of the filament transformer must be connected. This wire I have shown with a specially thick line in Fig. 3.

Little remains now to be done to complete the conversion. In the first place, it will be seen that a single dry cell is shown in the diagram connected between the "bottom" end of the grid leak and the common cathode connection. The reason for this is that in the normal battery heated valve a slight positive grid bias is given to a leaky grid detector by connecting the grid return wire to the positive limb of the filament. In an indirectly heated valve, however, positive bias cannot be applied in this way because the cathode is at the same potential over the whole of its surface. It is necessary, therefore, to bias the valve by means of a small battery. A single $1\frac{1}{2}$-volt cell is usually sufficient, so connected that its negative terminal is connected to the common cathode wire and the positive terminal to the bottom end of the grid leak. If desired, of course, the same effect can be obtained from the main grid bias battery, the normal G.B. plus plug being connected to the $1\frac{1}{2}$-volt negative tapping and the grid return wire of the detector to the positive terminal of the battery. In this case, all the negative grid bias plugs would have to be moved up one tapping.

Aluminium Railway Passenger Coaches.

The Pennsylvania R.R. has built passenger coaches in which all the metal work used above the frame is of aluminium or an aluminium alloy, the resulting reduction of weight being very considerable. An American railway has built a similar coach, the body of which weighs only about 5 tons, as against 11 tons for one of steel.

SHOPS SHED & ROAD

A Column of "Live Steam."

By "L.B.S.C."

About Big Cylinders.

Writing about the increase in the size of cylinders fitted to small locomotives (page 23, January 2 issue), our old friend Mr. P. W. Wilson fires a shot plumb into the middle of the bullseye when he remarks that hitherto some folk have been all at sea in these matters. They have; I can vouch for that all right by virtue of personal experience, and might as well now mention a thing or two which I found out by actual experimenting with locomotives on the old road at Norbury. Hours spent in "trying out" were recompensed by accomplishing lots of "impossibles," and proving that the rules and regulations of the "ready-reckoners" were for the most part all bunk. The Live Steam notes have not disclosed all, and probably never will reveal everything which came out in flat contradiction to the accepted laws of engineering; a few of my good correspondent-friends just love to "go by the book," and I wouldn't rub their fur the wrong way for anything, nor flout their acquired knowledge. However, for the sake of the cause, we might as well put it over the arabs who dictate "cylinder diameter mustn't exceed so-and-so, with boiler of such-and-such a size, because I have figured it all out."

The Rock-bottom Truth.

To put the whole issue into a few words is dead easy, and here they are. A certain fixed minimum amount of steam is necessary to shift a given load at a given speed. A certain fixed minimum amount of heat is necessary to produce that steam. Just that and no more constitutes the absolute facts. Maybe, it sounds curious; but listen. You may use—or rather may *waste*—a lot more steam than is necessary to do the job. The heat to generate the extra steam is wasted. Your generator may not be efficient; it may not supply the maximum amount of steam for the heat it absorbs; and a combination of all complaints explains the dismal failure of many commercial engines of the "carefully-designed" order. If we analyse, we find first that the valve gear is "modified" to cut production costs, usually resulting in the cylinders taking steam for full stroke, and exhausting late, with consequent back pressure. Our "careful designer" knows anyway how much steam it takes at boiler pressure to fill the cylinders twice in each revolution, and figures accordingly. The size of his boiler is determined by the "scale" of the engine, so he consults his "tables" again to find out how much steam he can reckon on getting. Incidentally, the said "tables" do not discriminate between heating surface over the fire where it is *hot*, or way up at the smokebox end where it isn't—but old Dame Nature does, and that's the rub! I remember some of the old L.N.W.R. Webb compounds which had a water-bottom to the ashpan, in direct communication with the water space at the sides of the firebox. This water bottom was reckoned in when calculating the heating surface of the boiler, yet—gospel truth this—on many occasions it *actually froze solid* when running on exposed parts of the line during severe winter weather. Gee—some heating surface that! But it just shows that you can't rely on "tables." Anyway, our designer puts on his consideration cap and ruminates something like this: "Hum, well, at so many revolutions per minute (you'll notice he always is sure his engines will go some!) cylinders will consume x volume of steam—holy James, the cylinders will have to be a whole heap smaller than scale, or the boiler won't fill them. Yes, that will do; we will make them half scale size, and then they will use exactly the amount that the boiler generates." He is awfully bucked at his reasoning, so sits down and gets out a lot more tables with columns of figures showing what size boiler will make steam for what size cylinders, and puts down what he calls heating-surface to cylinder-bore ratio, and a whole heap more similar junk. A few poor kites of novices take it all in as pearls of wisdom, never dreaming that, like as not, the compiler has probably never built a locomotive in his life. Fallacies take root, become firmly established and hard to shift, and so the merry old game goes ahead until some "fool rushes in where angels fear to tread" and swipes the blow-down cock. Then there is a glorious rumpus. I've had some, and thoroughly enjoyed it.

"Experientia Docet."

One advantage I had when trying out was a mind absolutely unfettered and unbiased by conventional training. Not that I had occasion to glory in my sublime ignorance—far be from me any such intention; and, indeed, I often regret that I never had any opportunity to practise such an art as draughtsmanship, for example, so I could better put before you many new details of cylinders, valve gear and other necessaries of efficient working. But from early childhood I've had to work hard for every dollar, and that explains many things. Well, soon after the "Battle of the Boilers" episode, I started in to rebuild a commercial 2½-in. gauge 4—6—0 with a coal-fired loco-type boiler, the original water-tube gadget fired by a six-wick poison-gas plant being totally unable to make steam enough to keep the engine going. The cylinders were ⅝ in. by 1 in., and the valve gear single-eccentric link motion, with no lap nor lead on the valves, and 100 per cent. cut-off. My boiler made steam enough and to spare; but the oiling arrangements being poor, and the new boiler supplying steam good and hot, the soft brass cylinders began to hang out signals of distress after the third run. I told the owner,

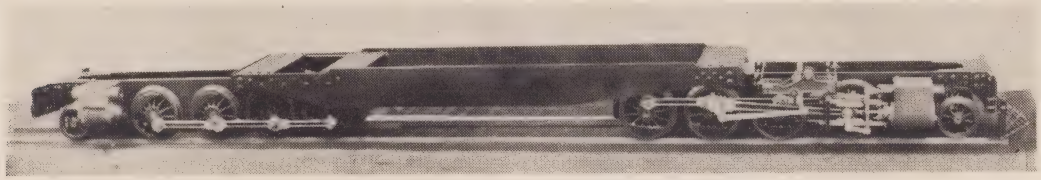
and he said go right ahead and fit a new pair, which was done; but as the only castings I had on hand were for ¾-in. bore I used those, and took the opportunity of adding another eccentric to each side, thus converting the engine to Stephenson link motion. Of course, my cylinders had proper valves with lap and lead; the net result being that the engine with bigger cylinders and proper timing had three times the life and power, and used *much less* fuel and water than before.

My next job was a new engine, also 4—6—0 type, with cylinders ¾ in. by 1⅛ ins. I knew the specified coal-fired boiler would steam them all right, but when I was through with the chassis it suddenly occurred to me to test it with the discarded water-tube boiler which had proved inadequate for the commercial engine with smaller cylinders. It was soon fixed up temporarily, poison-gas plant and all complete; and the results were what I had anticipated. The old boiler not only made all the steam needed by the new chassis, but more; she would start with 50 lbs. on the gauge and work up to 90 whilst passenger-hauling. The next experiment was to block up two of the wick-tubes; and with four wicks only, a bare ½ in. in diameter and not over high, it was possible to haul a passenger for close on thirty minutes, on one charge of water, steam being maintained steadily at 70 lbs. Note the pressure. The burners maintained the boiler at a certain temperature equivalent to steam at that pressure; if you shut down she would take a dickens of a time to blow off, and when restarting with the load as before, still only using four wicks, she would gradually drop to 70 lbs., and stick on it. This was but one of the many occasions where I have found that it isn't actually square inches of heating surface which does the trick, but the temperature you can maintain on the boiler *whilst taking steam from it.* Put in a crude way, when driving the engine at 70 lbs. pressure she was using, in hot steam, the exact amount of heat the burner was putting into the boiler. Most folk know that a sudden drop in pressure will cause a corresponding fall in temperature. When I test a pop safety valve by compressed air, and there is any moisture around the seating, tiny bits of ice and frost can often be found around the inside of the barrel. The reason why the boiler would not steam the commercial engine was that the drain on the boiler caused by the dud cylinders and motion was so great that the heat was taken up before the burner could replace it. Had I put a powerful kerosene burner under her in place of the methylated-spirit apparatus she would probably have maintained pressure; but I don't love the "gospel of the big stick." I cannot bear to see a full-sized locomotive "pasted."

Well, the next trial came when another ⅝-in. by 1-in. Atlantic of the L. & Y. type with inside cylinders came in for overhaul. This was a privately-made outfit and good workmanship had been put into it; but the builder had been following the everlasting ritual, and she mopped up steam to beat the band with the original valves and timing. The pistons and bores were O.K., and didn't need any titivation; but the valves and ports were all anyhow, so I recut the ports as big as the steamchests would allow and made new valves. Timing was "tram-ticket" lead and 70 per cent. cut-off. On went the old commercial boiler again for another experiment. Now listen again—with the same load as on the previous trial, and the same required speed, it naturally needed a higher steam pressure on the smaller pistons, and I anticipated that the gauge would stick around a higher figure. It did; she ran somewhere around 85 lbs., but the measured quantity of fuel and water lasted exactly the same time as on the previous test when the boiler was supplying steam to the larger cylinders. I tried this stunt with several different sizes of cylinders after that, always using the same boiler and noting the consumption; and it was patent to see that it always required a certain volume of steam to do the fixed amount of work. The size of the cylinders didn't signify. If they were small, the pressure boosted up; if large, the pressure was much lower; it was the *volume* that remained constant. Condensation I didn't trouble about, and I guess it didn't trouble me, as there was any amount of superheat, and I never got any water thrown from the smoke-stack during any of the tests.

Keep Some Power Up Your Sleeve.

Well, thought I, why not give our little bit of steam a still bigger piston to push against; and as a coal-fired boiler can maintain any temperature within reason, according to the blast and the rapidity with which you can burn up the fuel, there is no reason why every miniature locomotive should not have cylinders equivalent to those on its big sister. You then have power enough to start the heaviest load it is desirable to pull; and the engine, when under way, should use no more steam than if she had the small cylinders as recommended by the "old school." In fact, she should use less, as the big pistons are more susceptible to working on expansion. Steam that has expanded to low pressure would still exert an appreciable push on a big piston, whereas it would probably have no effect on a small one. I tried this out, and it proved absolutely successful; not only with coal-fired boilers, but with water-tubers fired by both kerosene burners and poison-gas plants. Anybody reading these lines who visited the Model Railway Club's Exhibition in London (Kingsway Hall) in April, 1929, will remember "Lady Kitty" on the track. She is a 2½-in. gauge G.W.R. 2—8—0, and has a "scale" boiler; her cylinders are ⅞-in. bore by 1¼-in. stroke; she can pull with a capital P (you want to get Bill Massive's confirmation of that!), yet she uses no more steam than Mr. Tye's "Princess Mary" 4—6—0 with cylinders 11/16th in. by 1⅛ ins., or "Lady of Narragansett" with cylinders ¾ in. by 1⅛ ins., when working equal loads. I need not dilate any further on this subject, as I have already mentioned one or two oil and alcohol-fired jobs which have run very well with big cylinders; and would strongly advise every builder of a little locomotive to fling all the old ideas into the ash barrel, use his own judgment, and fit cylinders equivalent to those of a corresponding full-sized engine—bigger still if he likes. Mr. Calvert Holt and I are just about to start on a 3½-in. gauge Baltimore and Ohio 4—8—2, and she will have cylinders "over-scale." The big engine's cylinders are 30 ins. by 32 ins., which gives an equivalent of 1⅞ ins. by 2 ins. for the "ette." We are going to stick



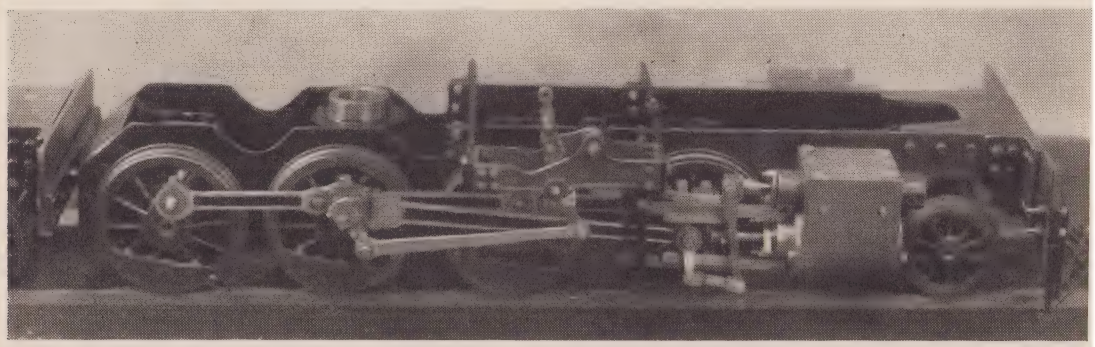
Garratt Type 2—8—0+0—8—2. By Mr. V. H. Messer.

on a bit of makeweight for luck, and have them 2 ins. by 2 ins. And they used to solemnly chant "three-quarter bore, three-quarter scale"—oh, gee, it gives me pains inside to recall it.

Old friend Wilson is right enough when he says we can get no more power from a locomotive than we put into it. You bet; but we ought to get as much as we possibly can. The day will never come when a steam, or, in fact, any locomotive, will attain 100 per cent. thermal or any other old brand of efficiency; but there is nothing to stop us carrying out experiments or following the direction of our own commonsense, without regard to "ritual." I do not agree with him that the points he mentions all bear a definite ratio to each other, and that we stumble upon correct proportions by accident. I know from actual experience it is not so. If he had had as many differently dimensioned engines through his hands as I have, he would find that the actual proportions of the various parts, boiler and cylinder ratios, etc., etc., don't matter a tinker's cuss within reason, so long as the grate itself can support a fire, or the burner works properly, whichever the case may be; the blast-pipe and chimney arrangements correct, and (most important of all) the cylinders and motion properly fitted. All you then have to do is to burn fuel, boil water, and distribute the steam so you get the minimum of waste. All delightfully simple, and nothing to write learned treatises about.

"Give a Dog a Bad Name"

It isn't always correct "proportioning" which gives the best results, and engines which may be as near mechanical perfection as it is possible to make them may get a bad name among both the engineering fraternity and the travelling public, by adverse circumstances. I know of a case in point where one of the finest locomotives ever put on rails went out one wet, dreary, and windy evening to haul an important express. The driver was a "spare," not over intelligent (a product of the "seniority rule" which is the curse of the railroads and the greatest enemy that efficient operation has to contend with) he knew how to open and shut the regulator, apply the brakes, look out for "boards," and precious little more. The fireman was about as handy with a scoop as a cow with a musket. The boiler had been running about three weeks without a washout, and badly needed one. The coal on the tender was a lovely consignment of dum-dum. To add to the gaiety of the proceedings, a special went out two minutes in front and caused delay in starting, and one or two signal checks ere it diverged at a junction and left the other train a clear road. The crew handled the engine very badly; she steamed shy because of the bad coal and dirty boiler, and the rotten weather capped the lot. Net result, 22 minutes lost in just under 200 miles. In the train was a well-known "stop-watch fiend" who was prejudiced against the particular line, because the chief mechanical engineer had stopped his footplate passes for a reason which has nothing to do with these notes. He promptly wrote a diatribe against the particular class of engine, with a log of the run, and it appeared in several semi-technical journals; the readers of which, not knowing any better, took the writer's opinions for gospel. It was also brought to the notice of the directors, and there was an inquiry into the whys and wherefores which cost a considerable sum. You can guess the rest! Yet the night after, the train was run by a rotten old crock of a locomotive, the proportions of which were all at variance with modern ideas, one being a boiler apparently too small for the cylinders. But the old cat was superheated, the driver and fireman were artists in their profession, and she came in on time. It just needed a certain amount of steam to work that train; and the boiler, intelligently fed, supplied it; whilst the careful manipulation of regulator and lever by the engineman, used the steam in the cylinders to the best advantage and did not drain the boiler. A little engine with big cylinders and an undersized boiler can, by means of proper valve setting, be made to work quite



Showing Baker Gear on Mr. Messer's Garratt.

successfully; whilst another with a far bigger boiler and the small cylinders beloved of the careful-designer merchant, usually proves a washout through neglect of that vital point, correct steam distribution with lead and early cut-off. I guess that's sufficient for the present.

"Advance, Australia!"

Says the slogan, and gee!(long) they are doing it and all, on miniature locomotive work, anyway. On top of Mr. Gray's S.300 loco recently illustrated we get news of the first—to my knowledge — 2½-in. gauge Garratt of the 2—8—0 + 0—8—2 type now under way. I know of smaller and simpler editions of the Garratt-type engine—Mr. R. Gowlland has one completed—but Mr. Vic Messer gets right there with his lengthy specimen, illustrated herewith. She follows in general the Beyer-Peacock-built Garratt which was illustrated in this paper in April, 1926, but Mr. Messer has put a bit of his own design into it, as all good engineers shouldn't hesitate to do, by adopting the Baker valve gear. Personally, I am certain he will get a better distribution than if he followed the valve gear on the original engine. The chassis was exhibited at the October show of the local S.M.E. held at Adelaide, and scooped the first prize, also helped to rake in another prize given by Messrs. Harris, Scarfe, Ltd., for the best piece of work on a Drummond lathe. Hearty congratulations to a fellow member; I hope to pay him a visit one of these days, it being a sincere wish that I may be spared (and later have the means) to visit at least one meeting of every S.M.E. whose membership cards I hold. Some trip!

Well, friend Messer sends one or two queries with the photos, and as other loco fans may be in need of the information ere long, might as well deal with them here. He wants to know the best means of making the flexible steam-pipe joints, ruling out the coiled tube stunt. The best flexible joint I know is the plain gland and stuffing-box. If he runs the steam pipes through the pivots, using glands, there won't be any trouble with the steam supply; but the pipe under the chassis leading to the engine at the back end should be lagged to prevent excessive cooling. Use a good superheater, about six elements of the usual spearhead pattern; don't be afraid of making the steam too hot on this class of engine. Two regulators are not needed. The bottom (hot) superheater header can have two unions for live steam pipes leading to front and back engines respectively. Exhaust connections can be made with ¼-in. diameter flexible metallic tube which can be obtained commercially, and *not* at fancy prices. Lubrication will need looking after carefully, and I would suggest the use of a big single lubricator, either mechanical (will give details soon) or displacement of the hydrostatic type, with a separate steam feed direct from boiler, and screw-valve controlled outlets to each engine. I am just trying out a double hydrostatic on a big American 3½-in. gauger, and if it proves O.K., will tell you all about it very short, also give a picture of the engine.

Model Aeronautics.

Model Aeroplane Propellers.

By W. E. Evans (S.M.A.E.)

(*Concluded from page* 189.)

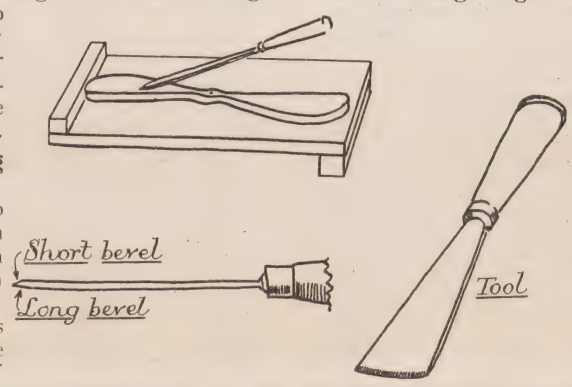
Carving Propellers.

This part of propeller making is rather troublesome to anyone who has no knowledge of the elements of wood-carving. But anyone who had wood-carving lessons at school should experience little difficulty in this process.

The paraphernalia recommended for this consists of a bench stop-block as shown in sketch; this may be placed on a bench if available or on the kitchen table. A wood carver's gouge ¾ in. wide with only a slight curve on cutting edge, a small wood rasp or file is useful for shaping the blade near boss, and some sand-paper, medium and fine grades, for finishing off.

Sharpening the Carving Tool.

Anyone able to sharpen a chisel on an oilstone can sharpen a gouge, but in addition to a flat oilstone a shaped oilstone slip is required to sharpen the hollow upper side of tool. This stone should be rounded on one edge, the curve being slightly smaller than that of the tool. A long bevel should be made and maintained on the underside of gouge and a short one on the upper side, the angles being about equal (see sketch). The under-side is sharpened on the flat oilstone by moving the tool from side to side instead of to and fro as in the case of the chisel. In doing this a slight turn is given to the handle as the tool is moved along the stone to keep the bevel an even length right across. Anyone not wishing to go to the trouble of sharpening a new gouge may get this done at a good tool shop when purchasing it. It should remain sharp for a considerable time if proper care is taken by keeping it wrapped up when put away.



Carving Propellers.

Carving a Propeller.

Although some propeller makers make use of a small spokeshave or a small draw-knife to remove the bulk of the waste wood to save

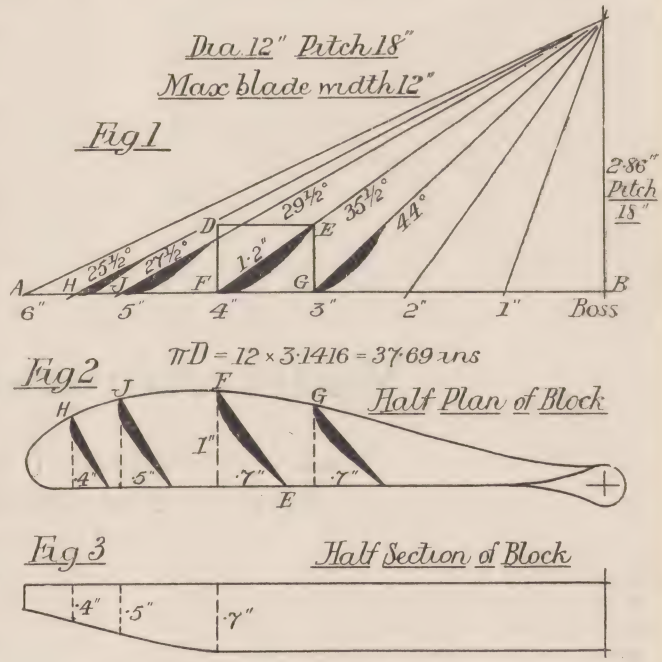
time, I think the amateur would do best by sticking to the gouge throughout.

Having got the correct size and shape of propeller block, place it against the stop-block as in sketch and pare off the wood from the flat (or concave if preferred) side of blade. Don't take the wood off right down to the top and bottom edges of block before testing the angles because, if these are not correct, as they are almost sure not to be, this can be rectified while there is sufficient wood left to do so. When the side of this blade is finished carving, turn the block round and do the opposite blade likewise, getting the pitch angles correct from the tip to mid-way or more towards the boss; when this is done, turn the block over and carve the streamlined side of each blade. Before sandpapering, test for balance, and if one blade is heavier than the other, carve a little more wood off where it appears to be too thick until a good balance is obtained. Finally, sandpaper the propeller all over and again test for balance, any slight difference being rectified by sandpapering.

Designing a Propeller.

The design of propeller chosen for this article has been proved to be one of the best, inasmuch as the original propeller won a competition for static thrust in March, 1922 (designed and made by the author) and then in July, 1928, when in the possession of Mr. S. R. Badley, put up a record rise off ground duration of 65 1/5th secs. when this member of the S.M.A.E. won the Pilcher Cup. So that a propeller which is well designed and made and gives a good static thrust should be equally good in practice on a suitable model.

This propeller has a diameter of 12 ins. and a theoretical pitch of 18 ins. The blade width was $1\frac{1}{8}$ ins. at widest part, and probably even better results would be obtained by making the blade $\frac{1}{8}$ in. wide. This would necessitate a block about 1/16th in. wider and 1/32nd in. thicker. The static thrust recorded was 8.26 ozs. at 872 revs. per minute.



Design of Chauviere Propeller.

First procure a sheet of graph paper divided into 1-in. and 1/10th-in. squares. Draw a line AB (see Fig. 1) equal in length to half the diameter of propeller, in this case 6 ins. in length. This represents on a reduced scale the distance travelled by one tip of the propeller in one complete revolution, *i.e.*, 12 × 3.1416 = 37.69 ins. The vertical line BC is next drawn and represents the distance (allowing nothing for slip) travelled forward in one revolution, *i.e.*, 18 ins., which reduced to scale will be $18 \times \frac{6}{37.69} = 2.86$ ins. Mark the point C 2.86 ins. above B and draw the line BC. Then complete the triangle by drawing the line AC. The angle BAC will be the pitch angle at extreme tip of blade and is approximately $25\frac{1}{2}$ degrees. All the pitch angles mentioned are within a small fraction of being correct and are near enough for model purposes. It is necessary that the pitch angle within $\frac{1}{2}$ in. of the tip of the propeller should be correct, therefore mark the point H at $\frac{1}{2}$ in. from A and draw the line HC, then the angle BHC will give the pitch angle at $\frac{1}{2}$ in. from tip of propeller. This will be found to be $27\frac{1}{2}$ degrees. In a similar manner draw the lines JC, FC, and GC at 1 in., 2 ins., and 3 ins. from A respectively, the resulting pitch angles being $29\frac{1}{2}$, $35\frac{1}{2}$ and 44 degrees. The pitch angles nearer to the boss than 3 ins. will be found to be not constant owing to the design and shape of wood block, and it is impracticable to make these pitch angles constant. These angles will be too small, but this is of little consequence in practical model work. We require the maximum width of blade to be 1.2 ins. at 2 ins. from the tip, therefore mark the point E 1.2 ins. from F on the line FC. Now FE is the diagonal of the propeller block at 2 ins. from tip. Draw the rectangle FDEG, which is the section of the block at this point. This is 1 in. wide, and .7 in. thick. This is the basis of the drawing of the half plan of block (Fig. 2). On the half plan mark the point F corresponding with F in Fig. 1, 1 in. above the base line which is the trailing edge. Then draw the shape of blade as desired, but the curved leading edge line must pass through the point F. To mark the blade sections in Fig. 2, proceed thus: Draw the line FE at an angle of $35\frac{1}{2}$ degrees from Fg. If drawing is accurate, E will be .7 in. from g, corresponding with EG in Fig 1. The other sections at H, J and G should be drawn in a similar manner, with the angles corresponding with those in Fig. 1. In the final drawing (Fig. 3) showing the half-section of block it will be noticed that the block is chamfered off for a distance of 2 ins. from the tip. The thickness of block at 1 in. from tip is only .5 in., and, at $\frac{1}{2}$ in. from tip, .4 in. This chamfering should be done before carving, then one is not likely to carve the tip of the blade at too steep an angle which would spoil it. If the flat face of the blades is carved from edge to edge diagonally of the block, the

resulting pitch angles should come correct and correspond with the drawing. Care, however, should be taken not to carve down to a knife-edge for two reasons: firstly, in sandpapering the finished propeller, the blade width will be slightly reduced, which is undesirable; secondly, if the block is not quite accurate in measurements of width or depth, the pitch angles will either be too large or too small, and a little bit of wood left for trueing-up to obtain the correct angles is a safe plan.

Polishing Propellers.

The simplest and quite effective method of polishing propellers is to brush some French polish on with a camel-hair brush (mop). Give it three coats, and after each coat has become quite hard rub down with a piece of extra fine sandpaper using a little oil as a lubricant. This gives an eggshell finish.

Concluding Remarks.

Any size model aeroplane propeller can be designed by following the instructions given for the 12-in. propeller and substituting other figures for diameter, pitch, and blade width, as may be required. The shape of blade may be altered to suit individual tastes, also the width, but in doing so the correct pitch angles must be adhered to. Also, the position of maximum width of blade could be altered as desired either by designing it to be nearer to the tip or further from it. Whether it would be equally efficient is uncertain.

Correspondence.

Aerofoils.

DEAR SIR,—I must apologise for not having answered the queries concerning my article on "Aerofoils." I arrived in town from abroad to find myself under high pressure of work and have not been able to find the time to do my duty to your readers.

As both Messrs. Matthews and de Guerin touched upon the same subject, I intend to deal with them together rather than separately.

I quite agree with Mr. de Guerin that the statement of three forces was a slip and should be read four. Also that in steady horizontal flights these forces are equal in pairs.

Centre of resistance coincides with C.G. As Mr. de Guerin pointed out, there is no necessity for this, and many other groupings will fulfil our requirements. It was chosen because it represented the simplest arrangement of forces. It is not a result from what was stated first, and should not have been preceded by the word "hence." Once this is assumed the next conclusion follows.

In Mr. de Guerin's letter it is clearly shown that as long as the sum of moments of the forces around the C.G. are zero, the system is in equlibrium and the conditions of longitudinally stable flight are fulfilled. The arrangements he shows in his sketches are perfectly normal and more likely to occur in practical work, especially full-size, where considerations of view

Table of Propeller Pitches and Model Aeroplane Speeds.

Loading ozs. per sq. ft.	Cruising Speed. m.p.h.	Cruising Speed. ft. p.m.	Propeller. Theoretical pitch. Inches.		Propeller. Effective pitch. Inches.	
4	12.0	1056	15.9		12.7	
5	13.4	1182	17.7		14.2	
6	14.7	1296	19.4	20 per cent.	15.5	at 1,000
7	15.9	1398	20.9	slip	16.7	r.p.m.
8	17.0	1494	22.4		17.9	
9	18.0	1584	16.8		12.6	
10	19.0	1672	17.7		13.3	
11	19.9	1751	18.6		14.0	
12	20.8	1830	19.5	25 per cent.	14.6	at 1,500
13	21.6	1901	20.3		15.2	r.p.m.
14	22.4	1971	20.9		15.7	
15	23.2	2041	21.7		16.3	
16	24.0	2112	22.5		16.9	
17	24.7	2173	18.5		13.	
18	25.4	2235	19.1		13.3	
19	26.1	2297	19.7		13.8	
20	26.8	2353	20.1	30 per cent.	14.1	at 2,000
21	27.5	2420	.7	slip	14.5	r.p.m.
22	28.1	2473	.1		14.8	
23	28.8	2534	2 .7		15.2	
24	29.4	2587	2 .)		156.	
25	30.0	2640	19.1		12.6	
26	30.6	2693	19.8		12.9	
27	31.2	2745	20.3		13.2	
28	31.7	2789	20.6	35 per cent.	13.4	at 2,500
29	32.3	2842	20.9	slip	13.6	r.p.m.
30	32.9	2895	21.4		13.9	
31	33.4	2939	21.7		14.1	
32	33.8	2996	22.1		14.4	

Speed varies as square root of loading.

W. E. E.

and space in the cabin would prevent the simple arrangement to be obtained.

The action of the tail-plane has not been considered purposely for reasons given on page 584. There will always be a damping action which necessarily slows down any tendency to change the attitude of the machine, but this should not be so large as to entirely neutralise it, and elevators of such a size as to materially affect the flying qualities of a model are not used.

It should not be forgotten, however, that we *do not* want the model to be of the ideally longitudinally stable type. There is no pilot to fly the machine at the proper angle, and this has to be incorporated in the design. The flying qualities can be roughly approached by a correct grouping of the forces, leaving the final adjustments to a small displacement of the wing or warp of the elevator.

It amounts to this: The sum of the moments round the C.G. should constitute a small positive couple (tending to lift the nose). The C.P. and C.G. can be made to lie on the same vertical line which does away with the couple due to L and W, though this would not seem very easy to verify. But if the leading edge of the wing is taken as the origin, the C.G. will probably lie at the point ($\frac{1}{3}d$, $-\frac{1}{3}h$), where d is the chord and h is the height of the fuselage. In most cases the model will then glide at a small angle, but, of course, extreme types will need shifting of the wing.

From this it follows also that a high-wing monoplane will fly with its wing further back than a low-wing monoplane, which is shown respectively in B and A of Mr. de Guerin's sketches. It is clear that, in order to obtain a true picture of stability, the action of the tail-plane must be taken into consideration, which leads us to a discussion of too theoretical a nature.

The fact remains, however, that my attempt to simplify matters as much as possible has resulted in a too one-sided discussion of the problem, and I am glad that Mr. Matthews and more particularly Mr. de Guerin have called attention to it.—Yours faithfully,

JUSTE VAN HATTUM.

Society of Model Aeronautical Engineers.

The next meeting will be held at the Y.M.C.A., Tottenham Court Road, on Tuesday, March 4, at 8 p.m., when Mr. J. D. Batten, M.A., LL.B., will deliver a lecture on "Winged Flight." The meeting is free, and all interested are cordially invited.

Hon. Secretary, S. G. MULLINS, 72, Westminster Avenue, Thornton Heath.

QUERIES and REPLIES

Querists must comply with the Conditions and Rules given with the Query Coupon in the Advertisement Page of each issue.

Selections from Queries recently replied to.

3569. Making a Stage Dimming Resistance.—F. B. (Bolton).

Q.—Please inform me how to make a stage dimming switch to gradually reduce the lamp voltage to about half the normal amount. There are eighteen 220-volt lamps taking 980 watts in all when fully lighted.

A.—The list of head lights and foot lights includes the following:—

5	lamps of	60 watts	= 300	watts.
3	,,	60 ,,	= 180	,,
5	,,	60 ,,	= 300	,,
5	,,	40 ,,	= 200	,,
		Total	= 980	,,

To ascertain the total current consumption this represents, divide the watts by the voltage of the supply.

Thus $\frac{980 \text{ watts}}{220 \text{ volts}} = 1.454$ amperes. The joint resistance of the lamp circuit will then be $\frac{220 \text{ volts}}{1.545 \text{ amps.}} =$ 151.3 ohms. It is required to reduce the lamp voltage to about 100 when they are dimmed, and, assuming the resistance of the lamp circuit to remain unaltered, the current will then fall to $\frac{100 \text{ volts}}{151.3 \text{ ohms}}$ = 0.66 amperes, approx. As a matter of fact, the lamp resistance does not remain constant but alters with the changes in temperature of the filaments. Metal filament lamps have a "positive temperature coefficient," meaning that their resistance increases with temperature; whereas the old type of carbon filament lamps had a negative temperature coefficient, with a much higher resistance cold than they had when glowing. The resistance, therefore, of the modern metal filament lamps run on reduced volts does not remain constant, but diminishes by some 50 per cent. when just glowing, and in the present case would probably drop from 151 to about 100 ohms, taking approximately 1 ampere on 100 volts instead of the calculated 0.66 ampere. The estimation of current arrived at by this means when fully lighted and under "dimmed" conditions is intended to determine the necessary "taper" to give the dimming resistance in its current-carrying capacity. If the current in the lamp circuit amounts to 1 ampere with all the dimming resistance in, and it is required to reduce the supply voltage from 220 to 100 at the lamp terminals, this represents a drop of 220 − 100 = 120 volts through the resistance, and as volt drop is equal to amperes × ohms, it will need 120 ohms in the dimming resistance to cause a drop of 120 volts when a current of 1 ampere is passing through it. The values for the resistance, therefore, will be 120 ohms with a current-carrying capacity tapering from 1.45 to 1 ampere. As the difference of current is small, there is not much to be saved in reducing the section of the wire at one end, especially as it rather complicates the construction, and the resistance may therefore be wound with the same gauge throughout, namely, No. 22 S.W.G. enamel-covered Eureka. This has a resistance of 1.093 ohms per yard, and accord-

ingly there will have to be $\frac{1.093 \text{ ohms per yd.}}{120 \text{ ohms.}} =$ 109 yards, to provide the necessary 120 ohms. The simplest way to make the resistance is to get a piece of thin metal tube 4 ins. diameter by 12 ins. long, cover it with a layer of 30 mil. Micanite sheet and close wind the resistance wire upon it in a continuous coil from end to end. The two ends of the coil are secured by metal strips clamped round with a bolt and nut, while a sliding contact can be made of a similar clamp sliding on a rod and provided with an insulating handle, with a spring contact tongue allowing it to ride easily up and down the wires along a track that has been bared of insulation by glass-paper.

3532. Transformer for Copper-oxide Rectifier.—C. S. T. (Forest Gate, E.).

Q.—Kindly let me have winding particulars for a static transformer to work off my 200-volt 50-cycle mains, and supply 1 ampere at 14 volts from the secondary. It will be used in conjunction with a Westinghouse metal rectifier for a valve receiving set.

A.—The winding specification will depend upon the core size, and the latter upon the output required in watts, so that what this correspondent wants really is a complete specification. Using stalloy strips 1 in. wide by 0.018 in. thick, he should build up a rectangular core of the following overall dimensions: 5 ins. wide by $3\frac{1}{4}$ ins. high by 1 in. deep. This will leave a central opening $3\frac{1}{4}$ ins. long by $1\frac{1}{4}$ ins. for the windings, and a web 1 in. by 1 in. all round. On a 50-cycle circuit, the reactance factor of a core of this size will be eight turns per volt, therefore the primary will need 200 × 8 = 1,600 turns, and the secondary 14 × 8 = 112 turns, plus an allowance of about 10 per cent. if it is desired to maintain the full 14 volts output at full load—that is, a total of 123 secondary turns. The primary will consists of No. 32 S.W.G., and the secondary of No. 21 ditto, both D.C.C. copper. Both the coils should be wound on one long limb of the transformer, the secondary first and the primary over it. Further details as to construction and winding of small transformers will be found on looking up the last MODEL ENGINEER index, or there is a handbook entitled "Auto-transformer Design," by A. H. Avery, which deals very thoroughly with the subject.

3563. Makers of Insulating Materials.—A. J. D. (Mitcham).

Q.—An article on electrical work in your issue of September 22, 1927, mentions the use of "L.P.S. sleeving," also silk tape. I have been unable to obtain supplies of this through the usual channels, and shall be glad if you will suggest a likely address. I am rewinding a Lucas dynamo that has been burnt out. Would it be satisfactory to use enamel-covered wire, and are the coils when taped up rectangular in form?

The L.P.S. sleeving referred to may be obtained either from the Micanite and Insulators Co., Ltd., Empire Works, Walthamstow, E., or from the L.P.S. Electrical Co., Ealing Road, Alperton, Middlesex. A similar sleeving under the name of "Sistoflex" is to be got from Messrs. Spicer and Co., New Bridge Street, Ludgate Circus, E.C.4. The silk tape is obtainable from the first of the above three addresses. Replying to the other enquiries, armature coils wound from enamel-covered wire are usually very unreliable as the enamel covering is liable to break down through chafing or pressure due to expansion under the effects of heat. The only exception where it can be employed with advantage is in the case of very small armatures for high voltages, where the gauge is No. 40 or smaller. Double cotton-covering 6 mils. thick is the safest insulation for gauges between No. 24 and No. 30, while double silk is generally used for windings between No. 32 and No. 38. Anything heavier than No. 22 is usually wound with 10 mil. double cotton covering. The armature coils, before they are "formed" are not square but lozenge shaped. Full particulars of winding and forming these are to be found in A. H. Avery's "Dynamo Design and Construction."

PRACTICAL LETTERS *from* OUR READERS

"The Model Engineer" 1 h.p. A.C. Motor.

DEAR SIR,—I am glad to find so many readers are taking interest in the design of the 1 h.p. alternating-current workshop motor for which I had the pleasure of contributing a design in your January issues. Criticism is very welcome, but I would like all critics to please remember that the design is decidedly unorthodox in certain particulars, simply and solely because the workshop facilities of the reader were the first consideration, and that all details were carefully thought out, having particular regard to his pocket and equipment. That there are many alternative ways of arriving at the same result no one will deny, but I think it will be fairly obvious that as the first consideration of all was to avoid castings in any shape or form, the present alternative design for a self-oiling ring lubricated bearing on page 152 is a little off the track.

As shown in the drawings, it entails a fairly large casting without any location on the end frames to keep it centralised, and no means of holding the parts together. Further, the joints between housing and end frame, and between housing and front cap will be very difficult to keep oil tight. It is really surprising to one who has only limited experience how much trouble joints of this kind can give in actual practice; in spite of every precaution, oil insists on creeping through eventually, and the frame inevitably gets in a mess and collects dust just where it is least wanted. A sound self-oiling bearing necessitates a continuous casting round it; a design for a satisfactory ring-oiling bearing will be found on pages 104 and 105 of "The A.B.C. of Dynamo Design," and has been in use by the thousand for the last thirty years or more.

Apart from this, ball bearings are far preferable to plain bearings for A.C. motors, as the airgap between rotor and stator is so small that a worn bearing bush quickly leads to trouble in starting, whereas in a D.C. motor there is a larger gap and therefore more tolerance for wear and tear.

One more point I would like to mention before closing is that in my letter of February 13, on page 167, there is an omission. Where the blank appears in line 6 from the bottom please read "the section of an inverted letter U."—Yours faithfully,

A. H. AVERY.

"Milestones."

DEAR SIR,—Permit me to congratulate you upon the publication of the 1,500th number of THE MODEL ENGINEER.

It does not seem thirty years ago that I anticipated the first issue of a journal which was destined to bring so much happiness into my life.

I cannot forget the admiration I had for the courage you displayed in starting such a journal, because, in those days, a model engineer was considered an overgrown toymaker. He ploughed his lonely furrow and had to buy all his experience, as the literature on the subject was very elementary and of little help.

I well remember discussing model boilers with Mr. Davies (of Messrs. Lucas & Davies) and Mr. Martin, of West Ham. Their views on the subject were quite different. The result was that the early boilers I constructed were in the nature of experiments to discover the best for steam production. It was thought that the only heating surface of value in a model was the firebox, and that tube surface was of little value. Hence the water-tube fireboxes and large flues with water tubes which we developed in those days.

With reference to castings, Messrs. Martin, of West Ham, was perhaps the first firm to sell sets of castings for the construction of model locos. The first famous set being the 1-in. scale G.N. Sterling

8-ft. 4—2—2, a brief construction of which was described in the pages of *The English Mechanic*. The big-end of the connecting-rod completely spoilt the appearance of this model. Many model engineers of that period built this model, amongst those being the late Mr. W. Bashford and Mr. Bryant, of Cowes, Isle of Wight.

The other set of castings were of the famous C.R. Dunalastan, ¾ in. to the foot. The Metropolitan Railway possess a fine model made up from these castings; incidentally, the wheels of "Cosmo Bonsor" were obtained from the same set.

The advent of THE MODEL ENGINEER altered the position of the amateur mechanic altogether. It brought those interested in the hobby together and brought us into touch with firms of whose existence we had been in ignorance. This, together with the valuable contents of its pages, gave us an encouragement which we had never before experienced.

I well remember travelling purposely from Leeds to attend a meeting convened by yourself for the purpose of discussing the formation of a model engineering society. It was your first step towards introducing model engineers to each other, and it must give you great satisfaction to know that from that meeting has grown groups of men all over the world interested in the subject of model engineering.

The interest you personally took in the development of model power boats did much to bring about the terrific speeds of to-day. The first regatta you organised at Wembley Park even stimulated myself to construct perhaps the first flash-steam plant for a model boat.

Later, just before the war, you materially assisted in the first International Model Yacht and Power Boat Regatta at Enghien, Paris. As a result French, Belgian, Italian and British model enthusiasts were brought together for the first time. Those who were present and are still alive will never forget that memorable gathering.

Model locomotives have improved out of all knowledge, and the number of enthusiastic amateurs interested in the subject must be legion.

"L.B.S.C." and other writers in THE MODEL ENGINEER have done much in this direction, and long may they continue.

The power, efficiency, and economy of the 1930 model loco with its superheated steam, mechanical lubrication, correct valve setting, and using the expansion power of the steam to the best advantage is a very different proposition to the model of 1898. If the model moved itself in those days we were content, but now these little machines haul loads which would have staggered the grandparents of 1898.

Stationary engines; electrical models, wireless, etc., all testify to the progress which has been brought about by THE MODEL ENGINEER during the past thirty years.

We model engineers enjoy the subject as a recreation, but you have THE MODEL ENGINEER with you always and so must often look forward to a break-away during an evening or a week-end.

I am sure that many of us would be interested to learn of the recreations of our friend of the "Smoke Rings." Perhaps someday you will enlighten through their medium.

Finally, I wish to thank both THE MODEL ENGINEER and yourself for the number of staunch friends, both those gone before and those present, who have contributed so much to my happiness as a result of the advent of THE MODEL ENGINEER thirty years ago.—Yours sincerely,

JAMES C. CREBBIN
(UNCLE JIM).

Leaky Pens.

DEAR SIR,—Could any of your readers tell me how to cure a fountain pen of well-known make in which the ink creeps although kept upright in the waistcoat pocket? Each time the cap is removed it is quite wet with ink.—Yours faithfully,

CECIL R. F. EUSTACE.

Institutions and Societies.

The Society of Model and Experimental Engineers.

MEETINGS.—At Caxton Hall, Westminster, at 7 p.m. Friday, March 7, Competition, Track and Model Night. Cards of admission to this meeting are not offered to those readers of THE MODEL ENGINEER who received invitations to the last track meeting, but any reader who has not attended before and would like to see some high-class models at work, both stationary and locomotive engines, may have a ticket by writing to the Secretary for one. Thursday, March 27, lecture by Edgar T. Westbury, Esq., on the "Two-Stroke Engine." Readers and members who have followed Mr. Westbury's writings in this journal will need no assurance of an interesting evening. Mr. Westbury has a fine collection of slides to show and hopes also to bring some demonstration models. Will members please make a special effort to attend promptly to time on this evening.

DINNER.—On Monday next, March 3, a Rummage Sale will be held at the workshop. Since success begets success, these evenings are growing in popularity. Both buyers and sellers ought to attend. To borrow the slogan of a city firm, these sales offer an opportunity of obtaining "something you want for something you don't want." On Friday, March 21, a demonstration by Colonel Marchment on "Mottling." The Secretary would like to hear from some member who is able and willing to give a demonstration on lacquering.

Secretary, R. W. WRIGHT, 202, Lavender Hill, Enfield, Middlesex.

Victoria Model Steamboat Club (see page 200).

Notices.

The Editor invites correspondence and original contributions on all small power engineering, motor and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected, or not, and all MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., Ltd., 66, Farringdon Street, London, E.C.4. Annual Subscription, £1 1s. 8d., post free to all parts of the world.

All correspondence relating to Advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

Sole Agents for United States, Canada and Mexico: Spon and Chamberlain, 120, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed. Single copies, 14 cents; annual subscription, 5 dollars 50 cents, post free

Contents.

The asterisk (*) denotes that the subject is illustrated.

SALES AND WANTS

EVERYBODY'S MARKET

ENGINEERING & SCIENTIFIC for ELECTRICAL GOODS

Advertisements are inserted in these columns at the rate of **One Penny** *per word, minimum charge for advertisement,* **One Shilling.** *Single letters or figures are charged as words, and a compound word as two words. The advertiser's name and address are charged for.*

Advertisers who wish to separate *their announcements into distinct paragraphs must have not less than 12 words in any one paragraph, followed by the word "Below"—which is charged for.*

"Box" replies, *care of these offices, are charged 6d. extra to cover postages. The following words must appear at end of advertisement: "Box ——, 'Model Engineer' Offices." for which usual rate will be charged. (Advertisers need not include our full address.)* **When replying to a "Box No." advt.** *address your envelope: Advertiser, Box ——, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

All advertisements in these columns must be prepaid, *and remittances should be made by Postal Orders or Stamps, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

Please state under which Classified Heading you wish your advertisement to appear; the classifications are as follows:—

General, Models, Wireless, Motoring.
Tools, Engines, Electrical, Business, Wanted.

Advertisers are requested to send in their announcements as early in the week as possible, as although we accept advertisements up till the first post on Friday preceding the date of issue, **we cannot guarantee the insertion of those arriving on this day.** *Telephone: Central 9071.*

OUR DEPOSIT SYSTEM.

We will receive from intending purchasers the purchase money of any article advertised or sold by our advertisers, and will acknowledge its receipt to both the Depositor and the Vendor, whose full names and addresses must be given. Unless otherwise arranged beforehand between the parties, it is understood that all goods are sent on approval, and that each person pays carriage one way if the goods are returned. The deposit is retained by us until we are advised of the completion of the purchase, or of the articles having been returned and accepted. In addition to the amount of the deposit, a fee of 1/- for the sum of £1 and under and 1/6 for amounts in excess of £1, to cover postage, etc., must be remitted at the same time, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4. In cases of persons not resident within the United Kingdom, double fees are charged

The amount of the deposit must be sent either by Postal Order or Registered Letter **(Cheques cannot be accepted.)**

The fee mentioned above should be sent in Stamps or by Postal Order as a separate amount.

In cases of exchange, money to the value of the article should be deposited by each party. **We cannot receive the articles themselves.**

General

Watch Repairers.—Tools, Material, Watches, Clocks, Gramophone Parts. List free. Repairs guaranteed. All parcels fully insured. Illustrated lists Tools and Materials, 6d.—BLAKISTON & Co., Ainsdale, Lancs.

B.A. Screws, Nuts, Washers, assorted gross 2s., list 2d.; small Whitworth Screws, assorted gross, brass 3s., steel 2s. 6d.; trade supplied.—J. H. BENNETT, Station Road, Willesden Junction.

Mechanics' Overalls at Pre-War Prices.—2s. 11d. strong blue or brown drill. Washing and wear guaranteed. Direct from factory at makers' prices. A p.c. brings patterns, inch tape and self-measurement chart.—CURREY & Co. (Dept. B), 9, John Street, Thomas Street, Manchester.

Screws, Nuts, Washers. List free.—EDWARD EMPSALL, Trentham Place, Dewsbury Road, Leeds.

Bookbinding.—We supply Official Publishers' Cover and bind your parts with strong cloth joints. Returned carriage paid for 4s. 6d.—WILLS, Bookbinder, 123-125, Church Street, Croydon.

Transfers in Oil Colours. Buy from actual makers. Wood Inlay, Floral, Dutch, Japanese, Birds, Trade Signs. Selection any kind, 1s. 6d. Includes catalogues.—Below.

Cycle Lining Transfers, self-fixing. All usual colours. Child could apply. 1s. set.—Below.

Doll's House Brickpapers, Wallpapers, etc. Samples 2d.—E. R. AXON-HARRISON, Jersey.

"Model Engineer," Vols. 1, 2, 3, in original bindings and perfectly good condition; a unique opportunity, as these volumes are now out of print; best offer secures. Apply quickly.—Box 1338, MODEL ENGINEER Offices.

Springs! Springs! Assorted, compression and expansion. Twelve varieties from ¼" to 2". 2s. or one gross, post paid. 100,000 already sold.—SCARRS, LTD., Kirkgate, Leeds.

Cheap Printing.—1,000 Billheads, 3s. 6d.; samples free.—CRETEWAY PRESS (22), Buxted, Sussex.

Special Brass Brazing Spelter, 9d. oz., post free.—DEANE, Mounts Road, Wednesbury.

Swift's 1" Objective, 15s.; Polarizer and Analyser, 25s.; Side Silver Reflector on Stand, 15s.; Sub-stage Abbe Condenser, 17s. 6d.; Large Eyepicee, 1·27", 3s. 6d.; all standard sizes.—HEATH, 28, Loughborough Road, London, S.W.9.

Splendid Coloured Plates of Locomotives are now ready: "King George V," price 1s. 2d., post free; "Royal Scot," 1s. 2d., post free; "King Arthur," 1s., post free. Sent by return post.—PERCIVAL MARSHALL & Co., LTD., 66, Farringdon Street, London, E.C.4.

2,000 Army Gas Masks, 11d. each, 2 for 1s. 6d., post free.—FRANK, 67, Saltmarket, Glasgow.

Medical Coils, powerful hand magnetos, 3 magnets, 10s. 6d.; worth double; post free.—FRANK, 67, Saltmarket, Glasgow.

New Bolts, Nuts, etc., bright steel, slightly soiled, suit motor and general engineers, cwt. bag 16s. 6d.; sample 9 lb., 3s. 9d., post free.—Below.

2 B.A. and 4 B.A. Steel Bolts, new, assorted to 5" long, 300 2s. 9d., post free.—Below.

Magneto Screws, assorted for all leading makes, 3s. 6d. gross; Assorted Carbons, 3 doz. 3s. 6d.; Magneto Armatures, adaptable for many leading makes, with condenser, less slip ring, 5s. each, guaranteed.—MARCHANT, Tiptree, Essex.

Plant Complete for manufacturing Lead Toys, 20s. carriage paid.—STOWELL, Woodingdean, Brighton.

"Practical Workshop Mechanics" (illustrated), post free 10½d.—BENTLEY'S PUBLISHING CO. (Dept. M.E.), Halifax.

Ivory Cards, printed any wording, 100 2s. 9d.—ASTORIA PRESS, 113b, Park Road, Aston, Birmingham.

When communicating
with Advertisers our readers will avoid delay if they will kindly
state requirements clearly
—whether ordering goods or merely sending an inquiry. A stamp should be enclosed when asking for lists or particulars.

Aeroplane Wheels, new, fitted with Dominion 26×2½ heavy tread tyres, and new tubes. Pair, complete with axles and bushes, 70s., carriage forward.—Below.

Sheet Aluminium, 24×11" approx., 1s. 3d.; Chamois Leathers, 16×16", 1s. 9d.; Spanners, assorted dozen, 3s. 6d.; Files, re-cuts, assorted dozen 4s.—Below.

Bolts, Nuts Washers, etc., 7-lb. bag, 4s.; Trench Periscopes, in case, 2s. 3d.; Hacksaw Frames, with blade, 1s. 6d.—Below.

Above Postage Paid. Send for free list.—COLEY, LTD., Ordnance Works, Queen Elizabeth Road, Kingston-on-Thames. ('Phone 0365.)

To American Collectors of Antiques. A genuine Antique Chippendale Grandfather Clock, with Spanish mahogany case, made by Chippendale, brass and silvered arched dial, and original 8-day movement, in going order; triple-wind, "going," "striking" and "chiming"; museum piece; price 200 guineas; seen in London.—Write in first place to G. GENTRY, 66, Farringdon Street, London, E.C.4.

100 New Hoffmann Ball Bearings for 1¼" and 2¼" diam. of shafts, 3s. each.—GOODHAND, 7 Marlborough Road, Gillingham, Kent.

We Cut Wheels from ½" up, any diameter, material, bevel, spur, ratchet, screw gear. Singles or quantities. Quotations (stamp) to pattern or sketch. Invar Pendulum Steel, 48", 5/16" diam., 13s. 10d.; ½" diam., 5s. Steel list 2d. Catalogue 1s. 9d. of Watch, Clock, Jewellery Repairs, Tools, Materials, Sundries.—YOUNG AND SON, Chippenham, Wilts.

"Model Engineer," January, 1924, to June, 1929, 11 vols. as new, vols. 1 and 2 bound, 35 early numbers; also Metre Paddle Steamer Hull, *M.E.* design, sponsons and paddles fitted; £4 the lot; would separate.—WELFORD, Lymm, near Warrington.

Pulleys, Shafting, Plummer Blocks, Gear Wheels, Belting; also cheap Electric Lamps.—SWINNOW ENGINEERING Co., Bramley, Leeds.

Fencing.—Link Mesh Netting Machine and other plant for sale.—Particulars from "RECEIVER," 14, Market Chambers, Enfield, Middlesex.

Thousands At It! Building Butler's ½ h.-p. Petrol Motor from Sets of Castings at 9s. 9d. Illustrated Catalogue, 3d.—Below.

42" Saw Bench, admit 30", 18" ripsaw fitted, four guineas.—Below.

Engineer's Lathe, massive 6" heads, rest, 5-ft. 6" bed, three guineas.—BUTLER'S GARAGE, Littleover, Derby.

Old Rudge Motor Cycle Engine, complete with magneto, carburettor and pulley, £1.—Below.

Two-stroke Engine, about 174 c.c., less magneto and carburettor, 10s.—Below.

Cast-iron Brazing Pan, 20"×22", on stand, with large size foot bellows, £1; 3 h.-p. Omegar Motor Cycle and Sidecar, £4 10s. to clear; 2 speeds, kick start and clutch; slight repair necessary.—Below.

Two Welding Pipes, Generator and Purifier, £1 10s.; one Welding Pipe, with three tips, £2 10s. any reasonable offer accepted for above.—SMALLWOOD, 211, Dawes Road, Fulham, S.W.6.

Pressure Gauge, 400 lb. and 900 ft. water, by Stott, 30s.—Below.

Ball Bearings, self-aligning, one 90×40 mm. bore, one 95×38 mm. bore, 7s. 6d. each.—MARSHALL, 29, King's Road, Teddington, Middlesex.

Three-pint Silent Primus Stove, extra nipples, 8s. 6d.; 6 doz. 8-pole 1½" Stampings, 2s. 9d.; 4 doz. 2-pole 1¾" Stampings, 1s. 9d.; Brass Boiler Shell, 3"×7", 3s.—SHARDLOW, 26, Westwood Road, Nottingham.

Electric Soldering Irons. If you require a good Soldering Iron or a British-made domestic iron see advert. under "Electrical" heading in this issue.

"Valetta" Metal Cement. Supersedes soldering, Packets 1s., post free.—OAKES, Dove Holes, Stockport.

Cabinet Bed, full size, folds automatically. Startling new idea where space is limited. Easily, cheaply made. Full plans, details, 2s. 6d.—REID, Allanside, Dunblane, Perthshire.

"General"—(*Continued*).

You Will Find "Steam Car Reminiscences and Steam Road Transport," February issue, of special interest. The following articles appear:—"A Special Flash Boiler Automatic Control" (illustrated); "Stanley Water Level Automatic" (illustrated); "American Steam Buses Further Described"; "New Sentinel Wagon Engine and Boiler" (illustrated); "New Foden" also illustrated and described.—R. H. BOLSOVER, Eaglescliffe. Monthly 1s.

Two-cylinder Swift Engine, mounted stand, with magneto, carburettor, £3; Stuart 400 Gas Engine, electric ignition, tank, 50s.; 3½ h.-p. Triumph, magneto, carburettor, £2; C.A.V. 6-volt 6-amp. Dynamo, 15s.; C.A.V. Cut-out, 3s.; Set Relmac Change Wheels, new, 15s.—DOWNING, 30, Hamilton Street, Deptford, S.E.

Pressure Gauges, reading 120 lb. sq. in., 1½" dials, 1s., post 3d.—Below.

Powerful Double Convex Optical Lenses, 4½" diam., 2s. 6d., post free.—Below.

Watchmakers' Eyeglasses, very powerful, usually 2s. 6d., now 1s. 3d., post free.—AUTOLEX 53, Crofts Road, Kenton, London.

30 Steel Cylinders, 3½" diam., 6" long, convex ends, tested 160 lb., bosses brazed on for fittings, make fine model boilers, 5s. each; 20 new 1½" Whit. Thread Taps, taper or plug, 1s. 6d. each all post free.—GOODHAND, 7, Marlborough Road, Gillingham, Kent.

¼-plate "Cameo" Camera, folding pocket, rectilinear lens, 3 plate holders, film pack adaptor, brilliant and direct vision finders, shop soiled, 25s. —JUDD, 58, Connaught Street, Kettering.

No. 1 Wade Bench Lathe and treadle, 50s.; also Patrick B.G. Lathe, with stand, treadle, chuck, etc., £4; Bassett-Lowke Vertical Double-cylinder Steam Engine, 1½" bore, £2; Stuart No. 2 Steam Engine, £3 15s.—1, Hamilton Terrace, Potternewton, Leeds, Yorks.

For Sale, Cheap.—Stuart 1 h.-p. P.3 Engine, governed, in running order, on bedplate, with water tank, £5; been direct coupled to 60-volt 25-amp. Crompton Dynamo, heavy, 4-pole, ring-oiling machine, as new, price £6; both above have been in use for accumulator charging; have now changed over to town supply; also "Amanco" 2¼ h.-p. Petrol Engine, complete running order, for hard work, £6; 4 h.-p. Vertical Petrol Engine, £2; Supreem ½ h.-p. Engine, 30s.; Levis Engine for stationary, £2; all above can be seen any time at 51, Wilmot Road, Swadlincote, Burton-on-Trent.

Horizontal Engine, ¾"×1", in good working order, 10s.; 4½" Slide-rest, suit amateur's lathe, 12s.; 8 Volumes "Workshop Practice," part bound, clean, £2.—SUTCLIFFE, Royd Square, Hebden Bridge, Yorkshire.

Typewriter, Remington, 30s.; good order, clean work; Smith-Premier, £3 10s.; bargains.—Box 1377, MODEL ENGINEER Offices.

Gore for Clock Wheels. Every description. Motion and Train Wheels for electric clocks, with pinion wire, 5s. the set, post free. Send stamp for lists.—H. GORE, 240, Essex Road, Islington, N.1.

Amplify Without Valves! Complete Microphone Parts, with instructional diagrams, for "Magno" Amplifier, 2s. 6d. post free. Guaranteed to amplify all crystal (or valve) reception ten times.—COOK, 182, Cranston Road, S.E.23.

Grinding Head, with heavy iron stand and treadle, 15s.; Levis Motor Cycle, 1½ h.-p., working order, £2; 70 MODEL ENGINEER, offers; will exchange Portable Gramophone.—19, Milverton Terrace, Leamington Spa.

Hand Planer (bench), 16" stroke, S.A. cross-feed, £3 7s. 6d.; Fan, 3½" outlet, Boston Blower Co.; ditto, Gunther, 5"; 22s. 6d. each; Hobbies' "Imperial" Fret Machine, 45s.; 3" Compound-rest, 15s. 6d.—WILDMAN'S, Peveril Street, Nottingham.

Study Gyroscopic Phenomena with a Whitehead Torpedo Gyro, 10s. each, carriage paid.—JOHN GRAHAM, 644, Eglinton Street, Glasgow, C.5.

All New.—Hacksaw Blades, 10" and 12", 10d. doz.; Assorted Files, 5"-12" cut, 6s. doz.; 60 strips Blue-Black Emery Cloth, 1s. 6d. lot; assorted Split Pins, ½" to 1½", 4½d. gross; assorted Twist Drills, 1-16" to 3-16", 1s. 9d. doz.—MARSH BARTLETT, 58, Thorne Road, S.W.8.

"Let Me Explain," by Archibald Williams Most of us do not know how to explain! Try to "explain" a motor bicycle, or just your own ordinary electric light. The author has the gift of explanation, and deals with Aeroplanes, Big Guns, Cold Storage, Dredgers, Electric Motors, Escalators, Flour Mills, the Kinematograph, Mechanical Typesetting, Motor Cars, Paper-making, Snow Ploughs, Steam Engines, Steel Manufacture, Wireless Telegraphy, Wireless Telephony, Water Supply, and Wood-cutting Machinery. Just the book for the fireside! Price 8s. 3d. post free from PERCIVAL MARSHALL & Co. LTD., 66, Farringdon Street, London, E.C.4.

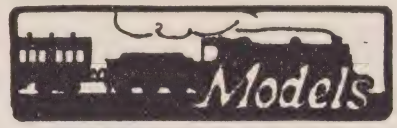
Home Cinematography.

Cinematograph Films and cheap British-made Machines, Accessories; list free.—"FILMERIES," 57, Lancaster Road, Leytonstone, London.

"Working Your Home Cinema." Useful information. Free lists, cheap Machines, Film Library.—"WAYLAND," 109, Kenlor, Tooting.

Here's Bargains.—Films, comics, 5s.; dramas, 5s.; Films exchanged, 1s. 1,000 ft.; splendid Machine, 60s.; stamp, reply.—A. MUNDAY, Pinden, Dartford.

Enormous Selection of Amateur Films, from 5s. each.—BAERS, 176, Wardour Street, W.1.



Boilers in Steel or Copper, all types and sizes; Locomotive Boilers from ½" scale made to fit your frames, flanged plates; supplied copper or steel.—GOODHAND, Marlborough Road, Gillingham, Kent.

Models Built, Repaired, Exchanges; speciality—Locomotives.—SALLIS, Mayfield Grove, Nottingham.

Electrically-driven Model Cargo Boats, 30" long hand carved and beautifully finished, 45s. each. Send 1½d. for full particulars.—FOULKES AND EDWARDS, Model Power Boat Builders, Sutton Weaver, Warrington.

Waterline Models.—Torpedo Destroyers, 4d.; Monitors, 4d.; Liners, 6d.; Battleships, 6d.; post free; reduction for quantities.—Below.

Goods Merchandise, gauge 0, 10 pieces, barrels, egg boxes, etc., 1s. 6d., post free.—HAILEY MODELS. 46, Queen's Road, Brighton.

If You Want that Locomotive or Stationary Engine Repaired, let me do the work; prompt attention; charges moderate.—F. HILL, 27, Northumberland Avenue, Reading, Berks.

100 Genuine Hornby Train Lines, straight, perfect, but rusted, for 5s. 6d., carriage forward; Gauge 0, 6s. 6d. per 100, carriage free.—CRITCHLEY, North Pier, Blackpool.

Petrol Engines for model racing boats, etc., latest water-cooled type. Easily, cheaply made without castings, etc., from our complete Constructional Drawings, 1s. 9d., post free.—COOK, 182, Cranston Road, S.E.23.

Gauge 1 Locomotive Outfit. Complete set of parts for building a £2 2s. loco, including a strong and long-running reversing mechanism. Brand new, packed in box, with tools and instructions. Accept 15s.—Box 1375, MODEL ENGINEER Offices.

Gauge 1 Clockwork Loco, accessories, parts, cheap.—W. G. KELLY, 48, Harcourt Avenue, Manor Park, E.12.

Bassett-Lowke "Duke of York" Loco, 1927, 8-volt permanent magnet, working order, cost 36s.; offers.—LANE, 15, Montpellier Grove, Cheltenham.

Powerful Gauge 0 Loco Permanent Magnets, 3"×1½" between by ⅝" wide, 1s. 9d. each; delivered free while they last.—GREGORY'S MODEL SHOP, 30, Ecclesall Road, Sheffield.

Models are Best when purchased from STEVENS AND Co., Venn's Gate, Cheddar.

The Latest!! Use Stainless Steel for your models. No more rust or corrosion, instead—everlasting brightness! Suitable for piston and valve rods, crankshafts, boilers, casings, boat hulls, domestic articles, etc. All sizes, sections, grades and finish can be supplied.—PITT, 29, Milton Road, Stretford, Manchester.

Stuart B.B. Engine and Dynamo, D.C., 55s. (cost £4 11s.); Box Bed; Heavy Flywheels, 2¼" and 9"; 200 ft. Heavy Continental Straight Rail; What offers?—Apply, 56, Sydenham Road, Croydon. ('Phone: Croydon 1026.)

Gauge 0 Lowke's Brass Permanent Way. Electric Steam and Clockwork Locos, Coaches, Wagons, Signals; cost £18; half price, or near.—LEETE, 9, Grove Park Gardens, Chiswick.

Martinside Monoplane, 6-ft. span, fitted with 5-cylinder rotary engine and compressed air chamber, capacity 260 cub. ins.; this model is in perfect working order, and is capable of long and steady flight; has wonderful stability and easily managed; £6 10s. secures. A spare Engine, as above, in running order, £2 10s. Air Chamber, with valves, £1 5s.—Below.

Four-cylinder Lucas Magdyno, 12 volts, complete with switchboard, guaranteed O.K., £3 10s.; would exchange for small Lathe or other Metal-working Tools.—"ADVERTISER," "Camelot," Riviera Drive, Southend-on-Sea.

Model Atlantic 4—4—2 Loco for sale or exchange; 6" Gauge, coal fired, water capacity in tender 1 gallon, two injectors, all fittings, in good condition.—WARD, 60, Salisbury Street, Swindon.

Model Overtype Steam Engine, new, will take 35s.—WEST, Fernleigh, Clyne, Neath.

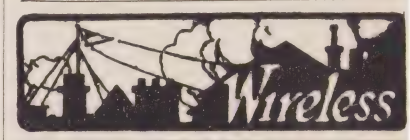
"Railway Pie," published by the Wimbledon Model Railway Club every quarter. Annual subscription 2s. 4d. Send 7d. for specimen copy. —27, Bernard Gardens, London, S.W.19.

Loco Enthusiasts! A new Paraffin Burner that fills the fire-box with flame, does not choke its nipple, starts up instantly, turned up and down like gas, also does your silver soldering jobs, and gives your loco maximum power. Complete burner, 2½" long, 1⅝" wide, 2" high, 5s. 6d.—"Lido," Ridgeview Road, N.20.

Bassett-Lowke L.N.W.R. 4—6—0 Loco and Tender, "Sir Gilbert Claughton," steam, in good condition, £3 10s.—G. O. RAWSTRON, "Croxteth Lodge," Ullet Road, Liverpool.

Gauge 1 Complete Scale Lay-out, locos, wooden coaches, and wagons, permanent way laid on baseboards, £25 or separately.—Below.

½" Scale North British Atlantic, with corridor coach (laminated sprung bogies), wagons and permanent way, £30; 4—6—0 Great Central, with track, £15.—HARDING, 21, Nicoll Road, Harlesden, N.W.10. (Willesden 5194.)



Wet H.T. Batteries, easy to build, long life, constant output, self-charging. Parts per dozen; Jars, 2¼×1½ square, 1s. 3d.; Zincs, 11d.; Sacs, 1s. 2d. doz.; dozen Cells (18 volts), complete with bands and electrolyte, 4s. 3d., post 9d.; Sample Unit, 6d. Illustrated booklet free. Wireless list free. Amplifiers, 19s.; Two-valve Sets, £4.—L. TAYLOR, 57, Studley Road, Stockwell, London.

If It's Wireless You Require send to the COLCHESTER RADIO STORES, 19a, Osborne Street, Colchester. All goods sent per return C.O.D. Our special Three-valve Set, complete with loud-speaker, £6 6s. This is a wonderful offer.

600-ohm Decoupling Resistances for screen-grid circuits, made and tested in our own workshops, 1s. 6d. each, post free.—GROVES BROTHERS, St. Mary's Place, Shrewsbury.

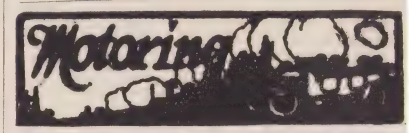
Four-valve Burndept Set, cost £100; works off mains; £20 or offer.—BASS & Co., 120, High Street, Rickmansworth.

Cosmos Three-valve Wireless Set, 65s.; One-valve Amplifier, 10s.; 6-volt Exide Accumulator, 25s., cheap; British Electric Lamps.—SWINNOW ENGINEERING Co., Bramley, Leeds.

Exchange.—Complete Parts and Valves "Everyman's Four," £9 worth, other Valves and surplus, Wiring Diagram for above. Wanted, Horizontal Boiler, 20×10 approximate, small Dynamo and Lathe considered.—ROBB, Vincent Street, Bolton.

Three-valve Outfit, complete with speaker and batteries, 70s.; Four-valve ditto, 90s. Wanted, A.C. Motor, 200 volts, ¼ h.-p., 50 cycles, single phase.—MORLEY, 37, Pendrell Street, Plumstead.

"Moving Coil Loud-speaker," as described in "The Wireless World," by F. H. Haynes. This booklet gives complete constructional details and dimensional drawings for building an instrument at a moderate cost, whose output is suited to home conditions. Price 1s. 8d., post free.—PERCIVAL MARSHALL & Co LTD., 66 Farringdon Street, London, E.C.4.



Auto-Wheel and Cycle, £5; offers; separated.—2, Bective Road, Forest Gate.

Morgan de Luxe Model, J.A.P., water cooled, 1923, in unbelievably good condition both mechanically and in appearance, special hood, patent jacking system, lighting and all electrical equipment in perfect order, splendid tyres, extra wide body, fully equipped, most carefully driven and maintained, equal to 1928 condition, taxed, offered at only £17 10s. to clear up a part exchange deal.—C. & C., LTD., Water Lane, Kingston-on-Thames. (Kingston 4585.)

Maxwell Car Engine, perfect, 30s.; Gear-box, 20s.; Back Axle, 25s.; Radiator, 15s.—Below.

Humber Engine, 60s.; Gear-box, 4 speeds, reconditioned, perfect, 40s. Want Lathe.—WALTON, 63, Benefield Road, Oundle, Peterborough.

Wanted.—Cylinder for old 4½ single-cylinder Humberette; also Engine to gear-box, shaft, etc., for old 4½ rear engine De Dion car.—KIRTON, Honiton, Devon.

Druid Light Forks, 7½" stem head, 15s.—77, Chatsworth Road, Bournemouth.

LIGHT MACHINERY
Sales and Wants

"SALES AND WANTS."
(*Continued from page* viii.)

Lathes.—Britannia, C.A.V., Drummond, Edgar, Eta, Exe, Milnes, Patrick, Wade, and all leading makes in stock —BUCK & RYAN, 310-312, Euston Road, London.

Lathes, standard makes, easy terms; lists free. —Machinery Dept., J. G. GRAVES, LTD., Sheffield.

You Needn't Take Risks! In 1907 we started making Chucks for *M.E.* readers, and, having stood the test of time, we're still going strong. We supply most leading lathe makers. Chucks sent on approval against cash.—Below.

Independent Chucks, light model, having four reversible hardened steel jaws, square thread screws, specially designed to screw direct on to Drummond, Britannia and other light lathes, saving overhang and weight and expense of backplates. Price: 3½" Chucks, 29s. 6d.; 4½", 33s.; 6", 39s. 6d.; 7½", 50s. If screwed to fit lathe, 3s. 6d. extra. Larger sizes same style up to 18".—Below.

Chucks! Chucks! Self-centring Chucks, Drill Chucks, Independent Chucks. All sizes up to 30" diam. 5,000 in stock! Write us before buying elsewhere.—Below.

Three-speed Treadle Motors for driving all classes of light machinery. Price on ball bearings, 56s.; plain bearings, 46s.—STERLING CHUCK CO., Cobden Street, Bradford.

Lathe Milling Attachments, Division Plates, Patent Combination Woodworker, comprising 5" lathe, 10" rise and fall circular saw, fretsaw, drill, and moulding spindle.—WHEELER CO., LTD., Trench, Wellington, Shropshire.

Pamphlets on Welding Cast Iron by Oxy-Acetylene, 1s. 7½d., post free.—BROWN, Pleck, Accrington.

Brownie 3½" Bench Lathes, 25s.; Foot Treadles, 35s.; Compound Rests, 15s.; stamp, particulars.—BROWN, Pleck, Accrington.

Lathe, 4" Drummond, stand, treadle, 3" self-centring chuck, accessories, tools, £9; new "Skinner" 5" S.C. Chuck, £1.—SWEET, 134, Wycliffe Road, Battersea, London, S.W.

Drummond 3½" Lathe, £14; 300 MODEL ENGINEER, 1924 to date; old Plain Lathe given to first inquirer.—SYKES, Sticklepath, Barnstaple.

For Sale.—A 4" Screw-cutting Lathe, with overhead gear, by Ed. Hines, of Norwich; will take 20" between centres; complete set of change wheels and a large assortment of chucks and tools; the whole in good condition.—Can be seen by appointment on application to H. G. D., 39, Eastern Avenue, Reading.

Sale.—3" Centre J.R. Screw-cutting Pedestal Lathe, complete, all accessories and tools, new condition; viewed by appointment; details for stamp; cost over £27. What offers, carriage forward?—L. W. PORTER, 81, Sweet Briar Walk, Upper Edmonton, N.81.

3 ft. by 2-ft. 6" Britannia Gap-bed Plain Treadle Lathe, compound rest, £5, complete; 6" Saw Bench for same, 30s.; Sensitive Drilling Machine, 0—⅝", 30s.; 4" Cushman, 25s.; 3" Whiton, 15s.; 2" Pinkney, 12s. 6d.; 2" Boley Vice, 12s. 6d.—57, Southend Road, S.E 9.

Compound Slide-rests supplied for the round-bed Drummond and also the Wade lathes.—Prices, etc., GEO. GOODMAN & CO., Engineers, Bristol.

Watchmaker's Tools, etc., 50s.—CARPENTER, Watchmaker, 12, Upper Richmond Road, East Sheen.

One "Rapid" Hand Shaping Machine, 8" stroke, swivel tool-box, cross traverse 7½", slotted table 9"×9"; One Hand Shaping Machine, 7½" stroke, with table 6½"×5¼", rise and fall of the table 4", swivel tool-box; in excellent condition.—JOHN CASHMORE, Great Bridge, Staffs.

Royal Enfield, 2¼ h.-p., 2-stroke, 2 speeds, good tyres and condition, new lamp set, £4 10s.; or exchange and cash adjustment for 3½" Drummond or Britannia Treadle Lathe.—43, Virginia Road, Wellfield, Huddersfield.

Treadle Drilling Machine, with sliding head, new, price £8. Castings supplied.—10, Tennyson Street, Keighley.

Lathe, 5" centre, treadle, 3-ft. bed, good condition; Horseshoe Double-blast Foot Bellows.—"Oakdene," Milner Road, Mitcham.

Wade Lathe No. 1, with foot motor, very little used, complete with tools, £5.—BELL, Southgate, Church Road, Urmston.

For Sale.—3" Treadle Lathe.—Apply, ALEX GRAHAM, 13, Forrest Street, Glasgow.

"Lang" S.S. & S.C. Lathe, 6½" centres, back-geared, full set gears, faceplate, countershaft, chuck, good condition, £8.—Below.

"Wells" ¾" Capstan Lathe, collets, and countershaft, £7.—Below.

Pillar Drilling Machine, geared, 20", worm wheel and lever feeds, £7.—Below.

"Corona" Ball-bearing Bench Drilling Machine, new, £3 10s.—MICKLEBURGH BROS., Windsor Works, 143, Walmer Road, North Kensington, London, W.10.

Middleton.—New Plain Lathe, shop soiled only, 5½" centre, 3-ft. 4" vee bed, 3-speed headstock, with ¾" hollow spindle, compound swivelling and graduated slide-rest, graduated feeds, complete with every accessory, including 7½" "Union" chuck (fitted), adapted for treadle motion also, £6 17s. 6d.

Middleton.—Plain Lathe, 7" centre, 4-ft. bed, compound swivelling slide-rest, tee-rest, complete with face- and catch-plates, centres, countershaft, £5 5s.

Middleton.—Quantity 1½" Shafting, 13-ft. lengths, with plummer blocks, 18s. 6d. each; Woodturner's Outfit, comprising 6½" centre headstock, tee-rest, and lever tailstock, 38s.; Woodworker's Vice, 7" jaws, quick release, 15s. 6d.; Grinding Wheels, slightly used, 6"×1" (¾", 1" holes), 1s. 9d. each; Polishing Bobs, about 9" diam., 3 for 4s. 9d.

Middleton.—Flypresses, No. 1 18s., No. 2 23s., No. 3 33s., No. 5, double-sided (Sweeney), 56s.; all with flys.

Middleton.—New Electric Lamps, from 110 volts, 12s. doz.; new Fellows Celluloid Accumulators, 6 volts 20 and 6 volts 60 amps., 12s., 22s. each.—Hudson's Drive, Cotteridge, Birmingham.

"Progress" 3½" Lathe, screw-cutting, gap bed, hollow spindle, £6 15s.; Dynamo, 8 volts 5 amps., 27s. 6d., new.—HOUGH, Toll Street, Nottingham.

What? What? An Engineer's Shop without a Lathe! A Garage without a Screw-cutting Lathe! Here, listen to this.—Below.

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